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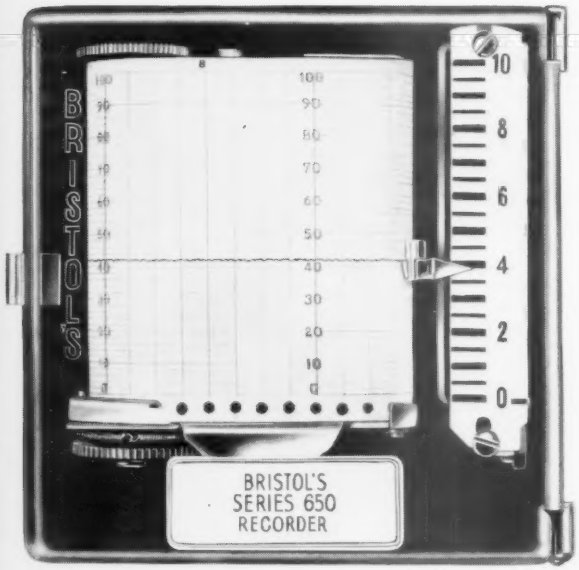

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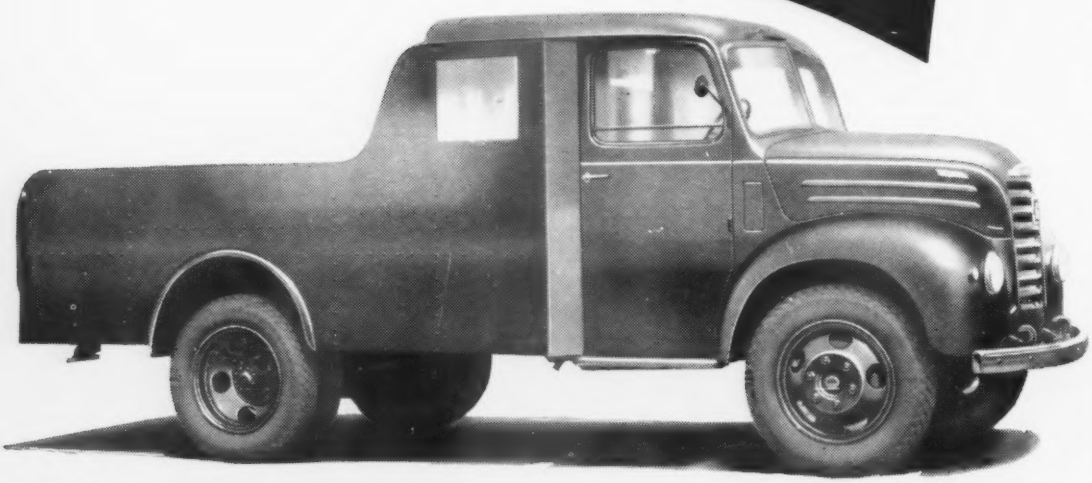

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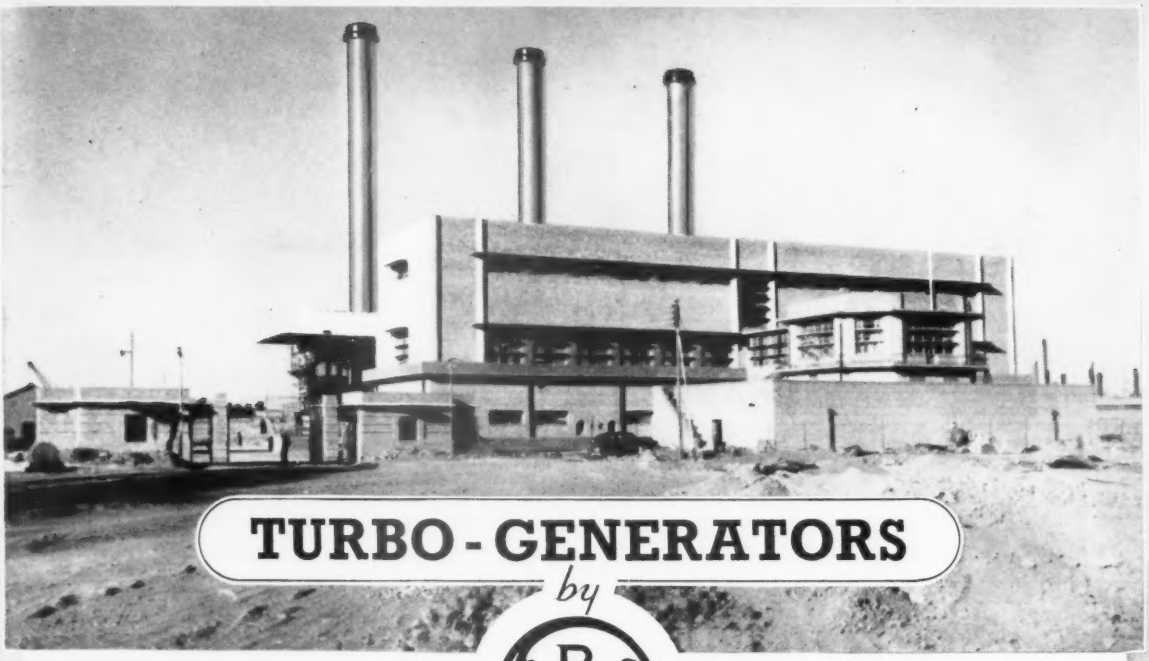

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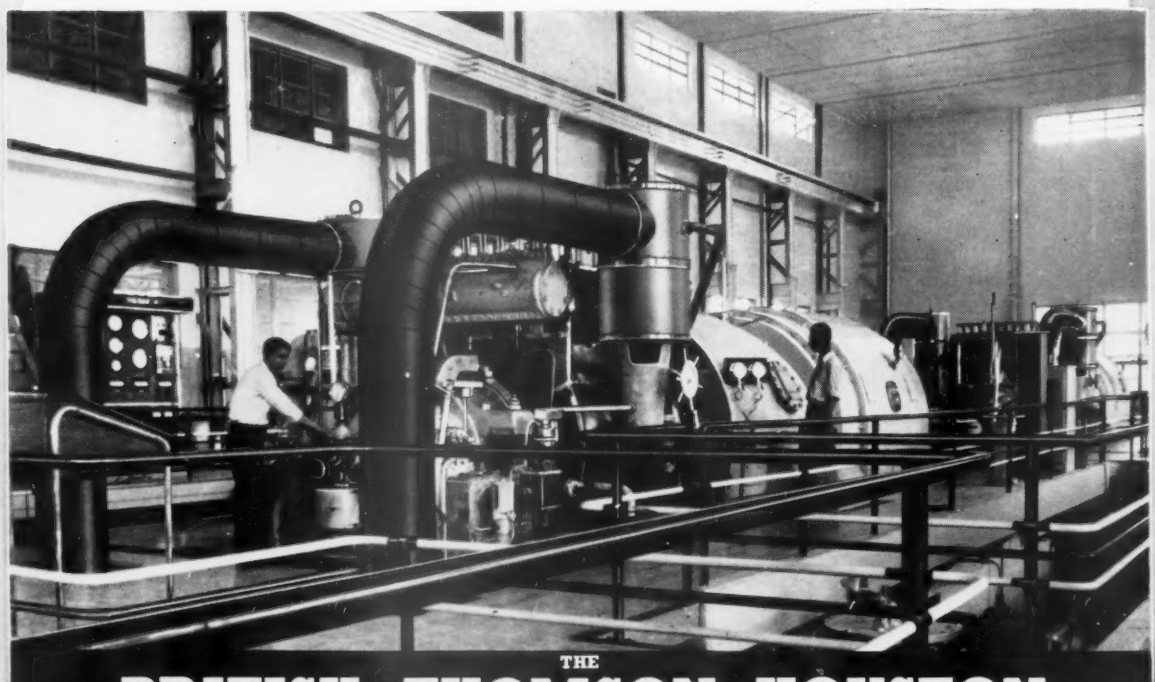

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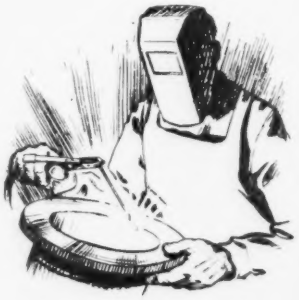

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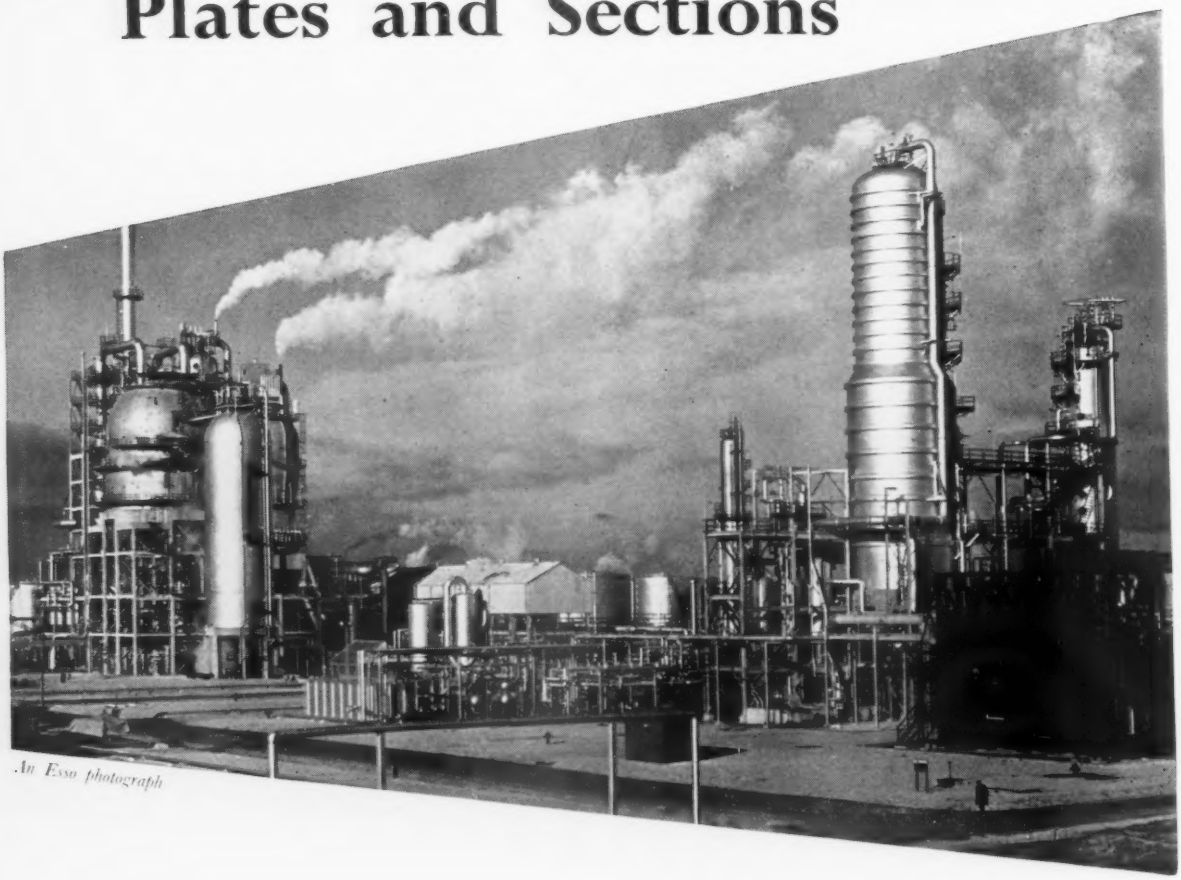

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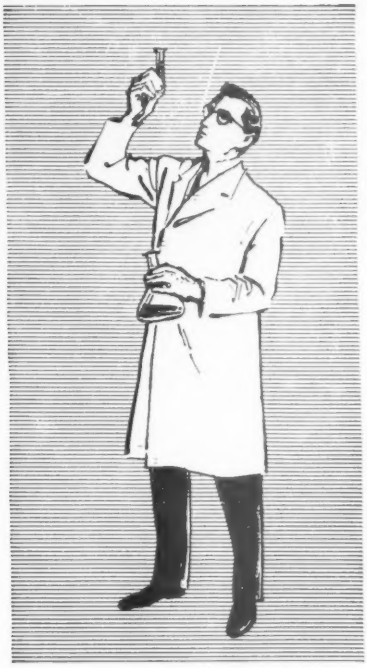

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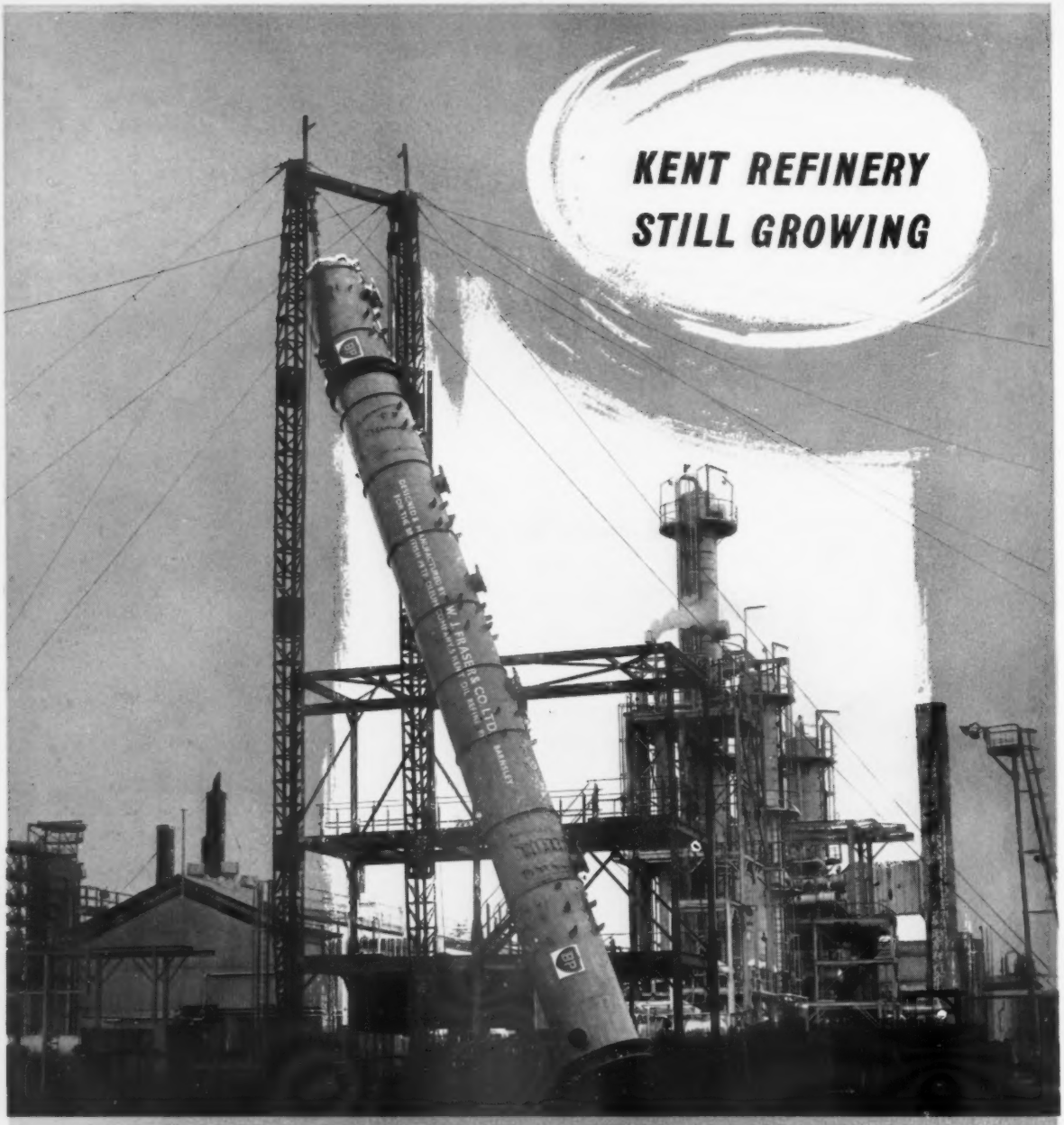

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The Economic Impact of Oil on the Arab Middle East

By JOHN MURRAY, O.B.E. (*Fellow*)

One of the outstanding developments in the petroleum industry in post-war years has been the phenomenal expansion in Middle East output and the even more rapid rise in the payments made to the countries concerned. Both as the largest industrial activity of the region—in some countries, indeed, the only one—and as the provider of development revenues, the petroleum industry now plays a major part in the economy of the Middle East.

In view of the great importance of this impact IP Review *believes that it is both timely and appropriate to present in its pages a series of articles concerned not so much with the oil operation in the Middle East—on which comprehensive studies already exist—as with its local economic effects. Discussion of these is often piecemeal and embedded in sources not readily available to readers; the aim of this series, which has been specially written by a consultant on economic and social aspects of the Middle East, is therefore to present a general view of the subject in convenient form.*

Introduction

This study deals with the impact of the petroleum industry on the countries of the Arab Middle East; and though the treatment may appear lengthy, it cannot, at least in its handling of facts, be much more than superficial, for this impact in the last few years has grown to such dimensions that it could properly form the subject of a sizeable book. Not only are the activities and payments of oil companies now a major factor in the Middle East economy, but so many countries are concerned, with such diverse ways and standards of living, demonstrating so many different effects of the operation, that the subject is in fact very complex.

Complexities seldom fall conveniently into boxes; nevertheless, certain broad divisions suggest themselves in the treatment. Any study of this nature must first define the region, attempt to describe it and the main factors operating in its economy in the past and still operative today, and deal briefly with the facts of the oil development which is in process of altering their balance. The nature of this impact can then best be discussed under three heads: the direct effect of the oil companies as employers, tutors, purchasers of goods and services—in other words, as a major local industry; the utilization of an immediate supply of industrial and transportation fuels in countries which previously had little or none; and the major consequences in economic development of the wealth now available to many Governments. The problems of the right utilization of this wealth merit much deeper consideration than is possible here: but in conclusion they can at least be touched on.

The study has therefore been divided into the following sections:

I The Middle East Region
II The Expanding Operation
III The Effect of the Companies
IV Fuel and Power
V Wealth and Development
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Part I The Middle East Region

The Region—its Complexity and Importance

At the outset it is necessary to define the area covered by the term "Middle East", which itself has undergone changes of meaning in the past 20 years. During and after the second world war the British Government officially included some 21 countries in its definition of the region; but among these were Malta, which certainly belongs to Europe, and Eritrea, Ethiopia, the Somalilands, and the Sudan, which are really African. They have therefore been excluded from the present study—as also has Libya which is a North African rather than a Middle Eastern country; Egypt, on the other hand, owing to her economic and political ties should clearly be retained in any discussion relating to the area. We are thus left with the group of Arab or related States—Egypt, the Lebanon, Syria, Jordan, Iraq, Kuwait, Bahrain and the other Gulf States, Saudi Arabia, the Yemen, Aden and the Aden Protectorate—together with Cyprus, Israel, and Iran.

These countries form something of a connected whole; in the words of W. B. Fisher,[1] "It would appear possible to postulate on geographical grounds the existence of a natural region to which the name Middle East can be applied." To them, also on geographical grounds, Turkey might be added, as in fact it has been in a recent United Nations study;[2] but for economic reasons it does not seem necessary to include it here. Indeed the list of countries will bear further pruning for the purpose of the present study; and it has therefore been decided to omit Cyprus, Israel, and Iran. The first is not an oil-producing area; it imports all its petroleum fuels and is not a heavy consumer; it does not form part of the Asian mainland; and the Greek majority of its inhabitants would certainly not sympathize with any attempt to connect it with the Middle East. Israel at the moment forms a pocket in the Middle East economy; and with the present political uncertainties, the country's unusual (though not unique) position as an importer of crude in the middle of a crude production region, the unknown quantity of its own oil possibilities, and its different culture and complex economy, it is better treated separately. These are clear cases; the inclusion of Iran, on the other hand, would be logical in that it is an integral part of the area, is strongly affected today by the oil industry and is in a most interesting stage of benefiting from it. It has, however, been decided to omit it for entirely empiric reasons: the effect of the renewal of oil payments is not yet marked, the development plans are in process of revision, and the revived oil industry is as yet feeling its way.

The countries left, then, are those of the Arab Middle East and to them this study has been confined. Though we have thus roughed out a region, it is certainly not one which is either simple or uniform. Among the States dealt with, for example, there are many varieties of political structure. Some are at least nominally democracies with the form, though not always the effect, of parliamentary government: such are the republics of the Lebanon and Syria and the constitutional monarchies of Iraq and Jordan. Though the throne in these latter countries plays a larger part than it does in Western constitutional monarchies, it is, nevertheless, limited in certain respects and there is an elected Parliament. Egypt, now a republic, is at present in a special stage of centralized government. Saudi Arabia and the Yemen are independent monarchies where the Ruler is virtually absolute; if there are any limits to his powers they are only those imposed by Koranic law and tribal custom. Aden is a British colony; and in the Gulf States the rulers are sheikhs operating under British protection and to that extent limited in absolutism, though they have full powers within their States. The gradual establishment within some of these, at least, of governmental services and a cadre of local or foreign officials, under the eye of British advisers, coupled with the personal character of the two rulers most concerned with oil, have resulted in a greater interest in the welfare of their people and a better internal organization than is common in feudal autocracies.

Physically and climatically the region is also varied, contrary to the general impression that it is entirely a land of sand and heat. The fertile alluvial plains of Mesopotamia and the Nile delta contrast strikingly with the deserts which are their immediate neighbours and, in the case of Iraq, the towering mountains of the Zagros which separate that country from Iran. The coastal plain of the Lebanon has a Mediterranean climate and is rich and fertile but limited in area; immediately behind it mountains rise to 10,000 feet, their slopes partly wooded and their valleys rich in fruit, with perennial streams and winter snowfields; only a few miles east the great plain of the Bekaa is also fertile though less well watered; and a few miles beyond it rises the Anti-Lebanon, producing a rain shadow in which little can grow unless irrigated. These contrasts could be multiplied all over the Middle Eastern area.

Geographical conditions in the Middle East are therefore complex, but no more so than the ways of life, which vary dramatically as between the townsmen and peasants, the poor and the rich, differing races and different or dissected religions. Tribesmen in their black tents, writing no language and engaged in herding and a little shifting cultivation, can be found almost next-door to the highly literate sophisticates of Beirut, speaking several languages, living in flats more modern than most in London, cocktailing on the terrace of the Hotel St. Georges and making their living by

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Away from the bright lights, life in the countryside goes on unchanged amid squalor and poverty.

dealings in foreign exchange ranging, if not from China, at least from Portuguese Macao to Peru. The old and new worlds are not even always separate; they may be superimposed as when the oil-rich Sheikh buys a dozen Cadillacs and an air-conditioner, yet preserves the dress and customs which his people had in the days when the Sword of Islam first cut its way from the desert into the softened empires of Byzantium and Iran.

These are not the only difficulties in the way of study: despite the immense amount which has been written about it in recent years, there is still much of the region which has not been the subject of close scientific examination. Fisher[3] points out that there are areas such as the Empty Quarter and the salt desert of central Iran which are to this day almost unknown, and adds that local prejudices and objections to economic and demographic investigations make it "difficult to obtain a picture of reality" almost everywhere. For these reasons some of the figures and even the apparently factual statements in the present study must be accepted with caution: the national income of Iraq, for example, has never been calculated, nor would it be easy to do so; but a *per capita* figure therefor has been repeated again and again in regional studies, although it is based on a United Nations' estimate which was inevitably tentative.

Nor are facts the only dubious elements in any Middle East study; economic and social concepts tend to be repeated in books emanating from London or Washington, Cambridge, Mass., or Cambridge, Eng., though they may be subject to a good deal of qualification when reconsidered in the light of a desert sun. This does not mean that the concepts so repeated are not basically true; the land tenure systems of the region, for example, are always correctly quoted today as a difficulty in the path of agricultural advancement. But how many critics hit this bull's-eye before the publication of Miss Doreen Warriner's excellent study[4] in 1948? Certainly not all of the administrators of the Mandatory Powers, who, with the best intentions, perpetuated the anomalies of land ownership by tidily applying the rules of Western registration to the East. Moreover the repetition of concepts makes little allowance for the constant state of flux in the Middle East, and exceptions, even when important, tend to be smoothed off as the rule rubs its way from mind to mind. So it may indeed be with the analysis in the next section, which must therefore be accepted as a statement of genuine and basic trends but not of complete and exclusive truths.

Strategically the area is of the first importance, not only in the strategy of war but also, in the broadest sense, in the strategy of peace. Historically this has always been so, for the Middle East, called by Mackinder "the heart land",[5] faces at once three continents and three oceans. It has therefore been the land bridge between the Far East and the West, and this aspect was only emphasized by the construction of the Suez Canal which merely facilitated in a slightly different direction the traffic which had always passed across this block of desert land. Today the area is also an aviation cross-roads (if this is not a contradiction in terms); and this has strengthened what an American writer, in a perhaps less than mellifluous phrase, has called "the geostrategic uniqueness of the Middle East".[6]

These elements in the importance of the area are, however, due to its position rather than anything inherent in itself. An immense additional significance has now been given by the fact that it has been found to hold the largest oil reserves of any one region in the world and more than half of the total world proven reserves. This is a new inherent importance which the Middle East has gained; and since oil is the life blood of modern transport and one of the greatest sources of all energy, the West is deriving from the region a physical benefit much as in earlier days it drew from it many of the basic elements in its cultural and spiritual heritage. From the Middle East came our alphabet; it was the source of the three great monotheist religions; and in the Middle Ages it was not only the bridge between the cultures of Asia and the then semi-barbaric Europe but a great originator of new scientific and cultural developments in itself. It is against this background of strategic, inherent, and historical importance that any study of the economic effects of the oil operation must be set.

The Economic Face of Poverty

Any discussion of the economic impact of the oil industry upon the Middle East must begin with some attempt at an analysis of the regional economy as it was before the industry developed and as it still largely is today—for it is not difficult to separate the basic factors from the new elements resulting from the work of the oil companies or the spending of the wealth now available to certain Governments. The outstanding fact about the Middle East, even yet, is its poverty: living standards are generally low and the whole area is, in the fashionable terminology, "under-developed". Nor are there many natural resources which can be developed other than the new-comer oil—cultivable land, water, and minerals are all in short supply; yet the population is growing and the poverty will become more acute unless the oil wealth can be used to develop such resources as there are towards the raising of living standards. Distribution, both of the wealth and of development potential, is, however, often unbalanced; in addition, various social, economic, and political factors have impeded progress in the past and retard development even now. An analysis of these points is attempted in the sections below.

The Limits of Natural Resources

This analysis may well open with a paradox: the first of the natural resources lacking in the Middle East is simply cultivable land, despite the fact that agriculture is certainly the major economic activity of the area. In some countries at least 80 per cent of the working population are agriculturalists and others are engaged in the transformation or handling of agricultural produce. Yet the region is one which in most areas is singularly unsuited to agricultural exploitation, though in other limited parts, *e.g.* the Nile Valley strip, parts of the narrow Lebanese coastal belt, and the better situated portions of the Mesopotamian plain, it is a land flowing with milk and honey. A great deal of the soil is indeed not cultivable at all, and of the cultivated area a good deal—often as much as half—lies fallow in any one year. Nor is all the cultivable land actually under cultivation.

The reason for this last is not far to seek. The rainfall of the Middle East is in most areas very scanty; some are so arid as to be desert, and what water there is in perennial rivers is often ill-distributed so that good land cannot be brought to life. Here and there, there is good rainfall; here and there, there are large rivers which, however, often suffer from difficult alternations of flood and decline. Thus water, in the words of an American writer, "is unfortunately available in limited areas and at limited times, a situation requiring many human adjustments. Water is the key to the economy of the Near East, the primary determinant of the distribution of population, and the chief factor in the location of villages".[7]

At first sight it would seem that the climate of the Middle

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Ancient rain water cisterns

East has become steadily drier during historic times—as, indeed, it is known to have done within the longer view of the geologist. The desert shows, in many places, traces of extensive irrigation systems, the remains of villages or even flourishing cities where today is an arid waste. And it is certainly the case that many parts of the region were more heavily populated, were more developed economically, and indeed had a higher level of physical civilization than they now have, even if it be accepted that—as was probably the case—not all the ruined settlements and irrigation works were in operation at the same time nor as large as is sometimes romantically estimated.

It was on this and similar evidence that the American geographer Ellsworth Huntington based his theory of "climatic pulsation in historic times", according to which the climate of south-west Asia has become drier within the last two or three thousand years, this change taking place irregularly in waves[8].

There are, however, reasons for doubting whether this hypothesis is strictly accurate within the limited period involved[9]. In the first place, many irrigation works have fallen into ruin not because the water available for them dried up, but because of invasion, misgovernment, or occupation of the area by nomads who did not understand their use. Secondly, irrigation works may have been abandoned because of a natural rise in the level of valley floors during historic time, coupled with an absolute or relative lowering of the beds of rivers, adjustment to such changes having proved beyond the skill of the less agriculturally-minded successors of the original engineers. A further factor in producing apparently increasing aridity has been soil erosion, due partly to the agricultural methods used but in the main to deforestation. In this matter the conditions favourable to the early growth of civilization in the Middle East carried the seeds of their own decay, for, as the population grew rapidly and urban civilization developed, the increasing demand for fuel, building wood, and ship timber, unaccompanied by systematic replanting, resulted in the gradual reduction of the forests and the stripping of surface vegetation more quickly than they could be replaced by natural regeneration. This in turn meant not only that less water was immediately retained in the mountain sides, but also that the soil was rapidly eroded, thereby permanently reducing the water resources.

It is possible that the scientific pendulum has swung too far over and that Ellsworth Huntington's theories are not entirely to be discredited: nevertheless, it seems clear that it is chiefly human factors which have contributed to the results which would superficially appear to be due to a recent drying-up of climate. This does not merely mean that man is not making the best use today of the water resources; there are also less water resources to use because of man's action in the past and because certain natural trends are in any case operating which man has not adequately resisted.

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This ruined city, which prospered in a virtually rainless region, is in Tunisia; both North Africa and the Middle East abound in such places, where man's ingenuity once contrived to make the desert blossom.

The rising tide of population Picture Post Library

Soil and water, then, are both doubtful quantities in the Middle East; and it must be emphasized that there is a further difficulty in that the combination of the two is not merely, in many areas, a simple matter of "bringing water to the thirsty land". Much of the soil of the Middle East is saline, or will become so after water has been applied to it for a period; and water must be used with skill when taken in relation to these soil defects and the long hot summer. An additional and very important factor is that of health. In Iraq, in particular, it is essential that irrigation schemes should not also contribute to an increase in bilharzia and malaria: Egypt has, of course, provided the classic example of the spread of the former disease when canal irrigation was extended.

Nor is the Middle East rich in mineral resources other than the oil which is the subject of this study. There are many mineral deposits but nearly all are small; most are found in remote areas, difficult to enter, with a long haul to such industrial centres as exist and to the ports. Moreover, the mineral regions are not only inaccessible, but also, by the same token, largely uninhabited. Major deposits would justify the capital development necessary for extraction on a large scale, but it is just major deposits which do not exist or at least have not been located. Moreover, the more accessible minerals and those which owing to their high intrinsic value are less dependent for their economic extraction on cheap and easy transport, have largely been worked out at earlier periods of history; just as with forests, the Middle East is here paying the price of having been the child prodigy of civilization.

The Rising Tide of Population

Not only is the Middle East deficient in natural resources but there are also considerable population pressures on those which do exist. At first sight this statement may appear ludicrous if the round total of some 40 million persons shown in Table I be set against the estimated area of the countries considered, amounting to nearly two million square miles. The limitations of soil and water, however, force this population to live on comparatively small portions of the total surface of the region. Some small countries are heavily populated in relation to their total area: this is the case, for example, in the small island of Bahrain and in the Lebanon. In other countries the mass of the people is compressed into the limited fertile or irrigable tracts, so that a state enormous in proportion to its population is actually over-crowded having regard to its agricultural potential. Thus out of the 363,000 square miles of Egypt only some 13,500 were actually settled according to recent figures; into these is crowded a population of 20 million so that at the date of the last census the settled area had the extremely high population density of 1411 persons per square mile.

Though this does not apply everywhere—Iraq, for example, is under-populated in relation to its cultivable area and the water available—it is true to say that much of the usable land in the Middle East is already over-crowded. And within these narrow walls the population has in recent years been growing at an alarming rate. Though all figures on the Middle East must be accepted with caution it seems probable that there is in most countries a natural increase rate ranging from 15 to 25 per thousand: in Egypt, for example, though the death rate at 20·6 per thousand is very high, so also is the birth rate (41·6 per 1000).[10] It is true that births are sometimes recorded and deaths left unrecorded, that census figures may be too low owing to fear of conscription or taxation, and that other factors may contribute towards exaggerating the natural increase rate; but even if allowance is made for these statistical deficiencies it is certain that the birth rate has, at least in the last few decades, markedly out-stripped the death rate in most if not all of the region. Today valiant efforts are being made to improve health conditions; this is *ipso facto* humane and laudable, but the natural consequence is that such rude checks to population growth as epidemics become less frequent. Though earlier estimates are not worth very much, it is significant that the official figure for the population of Iraq in 1930 was 2·8 million, while the census of 1947, which was reasonably accurate, showed 4·8 million; and the census figures of Egypt rose from 16 million in 1937 to 19 million ten years later. In the latter country this increase presents a serious problem, for the land which can be cultivated has definite limits imposed by the water supply: "Egypt's problem is,

in these circumstances, fundamental and simple to express, how can she feed her people now and in the future? In the last fifty years of agricultural development the population has doubled, the average land holding has been halved, and the average individual income has noticeably shrunken".[11] The position which still obtains in the Middle East was well expressed over ten years ago by Dr K. A. H. (now Sir Keith) Murray[12]: "The Middle East, in fact, is passing through the stage in population which Great Britain went through in the early 19th century, when death rates fell rapidly owing to the control of disease, and births continued at a high rate. When that occurs an abnormally rapid rate of population growth results, and unless the national economy can find possibilities of expansion, through the increase in production, the initiation of new lines of output, the development of closer internal links and a stronger position in the world trade, there must follow a fall in the general standard of living and all these increasing millions will not even be able to attain the present low level of food consumption."

Poverty and Potential

Such population pressure may not only result in a lowering of standards of living all round unless food production makes early and rapid strides, but actually make increased agricultural production more difficult, since there is a tendency for the peasant to take as much as possible out of the land without regard to future productivity of the soil. Yet it is false to assume that a population increase infallibly means a fall in living standards; in many countries the reverse has been the case: but such an improvement requires the conditions for an increased level of economic activity. Thus development of the region is urgently required; and this urgency is increased by the political unrest resulting from militant nationalism, which tends to blame economic difficulties and social disparities on foreign influence, by the growing consciousness of the poor of the gulf which separates them from the rich, by the drift to the cities which is producing an urban slum-dweller, and not least by the emergence of a middle class, as yet limited, which has learnt Western

TABLE I

ESTIMATED AREA AND POPULATION OF THE MIDDLE EAST REGION

Country	*Estimated Area (thousand square miles)*	*Population*	
		Working Estimate (millions)	*Basis*
Egypt	363	20·0 +	1947 census (19·0) and recent estimates
Fertile Crescent—			
Lebanon	·4	1·3	1943 semi-census (1·02), 1952 estimate (1·30)
Syria	71	3·3	1943 estimate (2·9), 1951 semi-census (3·3)
Jordan	37	1·4	Recent estimates, including 0·500 refugees; some estimates are slightly higher
Iraq	172	5·1	Estimate based on 1947 census (4·8)
Arabian Peninsula—			
Saudi Arabia	1200 (est. total area: frontiers in many cases undemarcated)	4·5	Approximate, based on K. S. Twitchell, *Saudi Arabia*, 1953 Edn.: estimates vary from 3·0 to 7·0
Yemen		4·0 +	Approximate: Imam's taxation check in 1952 showed 4·0 + but 8·0 is claimed
Aden Colony		0·1	Estimate 1950 0·100, 1952 0·130
Aden Protectorate		0·8	Estimate 1952: also estimated at 0·650
Muscat and Oman		0·6	Recent estimate 0·550
Trucial Coast		0·1	Estimated at 0·080
Qatar	8 (est.)	–	Estimated at 0·025
Bahrain	0·2	0·1	Recent estimate 0·115: 1950 census, 0·110
Kuwait	6 (est.)	0·2	Estimate
Total	1900 (rounded)	42·0 (rounded)	*Sources:* Royal Institute of International Affairs, *The Middle East—a Political and Economic Survey*, Second Edition, 1954; various United Nations and Government publications; Europa Publications Ltd, *The Middle East*, 1955

NOTE: The above figures should be treated with great caution: they are nearly all estimates and though in some cases, *e.g.*, Egypt, Iraq, Lebanon, and Bahrain, these are reasonably firm, others are virtually wild guesses. It is, strictly speaking, unstatistical to total these figures; but this has been done in order to give a general impression of the magnitude of population and area.

ideas and is rightly demanding social reform*. None of these criticisms can be met and problems solved unless the economy of the region becomes stable and the food supply and the standard of living rise, though at the same time it is true to say that economic development alone, without accompanying reforms, is not enough†. The three essentials for this development are something to develop, the technical skill—which may be in the form of external technical assistance—which provides the know-how for development, and the capital with which to finance it. The last of these is now available in some countries in the form of the oil revenues.

Unfortunately the development which can be produced by the expenditure of these revenues is in some States in a sense artificial, as though a man were being fed with vitamin capsules to make up a deficiency in his food. It is true that in some, such as Iraq, the natural resources of the country are such that this stimulation should be sufficient to ensure a more normal form of growth in the future; but in others, like Kuwait, the artificial element is more clearly marked. And unfortunately there are some countries in the region which neither have this adventitious assistance nor possess natural resources adequate to their growing population. Thus in the words of Fisher,[13] "For some communities it is a case of running hard, like Lewis Carroll's Red Queen, in order to keep in the same place".

The present writer feels that, though it may be an over-simplification, it is illuminating to grade the Middle East countries on a *plus* or *minus* basis in regard to development potential and the financial resources available. On such a grading only Iraq, and perhaps Iran, with which we are not concerned here, are in the fortunate position of being a double *plus*; Syria is a *plus* on development potential but much less so in cash. Egypt is a qualified *minus* on both counts; her budget is large but the standard of living of most of her people and, consequently, their spending power and taxability, are low; and despite the High Aswan Dam project the resources which she has to develop are limited by water and land availability. The Lebanon is perhaps a qualified *plus* on both counts; the country has few natural resources, it is true, but the skills of her people, the position of Beirut and her international commerce are all actual, if intangible, assets. She is not likely to share in any enormous oil wealth but she receives a great deal of it indirectly and there is a considerable potential for capital formation within the country. Nevertheless her position has not the strength of that of Iraq. In contrast to the foregoing, Saudi Arabia and the Gulf States are strongly *plus* in finance and almost completely *minus* in development potential; there money can be spent on producing largely artificial, if necessary, developments, in providing social services and ensuring their continuance in the future by investment; but it is impossible to envisage vast productive developments even in Saudi Arabia. Finally, the unhappy Jordan is virtually a double *minus*.

The Retarding Factors

Development in the Middle East is not merely a matter of finance, and the previous lack of a great source of Government revenue and general (though not universal) deficiency in natural resources, are not the only reasons for the poverty of the area. Certain factors, economic and social, have also retarded progress in the past and may still do so even when both these desiderata are available.

The first of these is the ancient system of land tenure, which is extremely complicated and subject in its different forms to a number of diametrically opposed faults. The bulk of the individually-owned holdings, for example, are either too big or too little; of these the larger are often the absolute property of feudal landlords, tribal sheikhs or the equivalent, in settled areas, of the mediæval Lords of the Manor, who too often are absentees either in the flesh—drawn by the cities or because they have widely-spread holdings—or in spirit, in that they pay little attention to the improvement of their land, being content to draw from it without effort their rents in cash or in kind. This, it is true, is not always the case: some of the most effective agricultural development in the Middle East has occurred when a modern-minded landlord has put back capital into the land and used his almost unrestricted powers for controlled development; but such cases, based on enlightened self-interest, are rare. In general, the peasant on such lands is a share-cropper without security of tenure, who consequently has little incentive to increase production, partly since he will only be increasing the landlord's share as well as his own and partly because the residue he receives is in any case very small and does not leave a surplus for use on improvements. This position has perhaps been made the more firm by the land registration which in the last two decades has been in progress in most Middle East countries, particularly in those formerly under mandatory control. It is undoubtedly true, as G. F. Walpole, then Director of Lands and Surveys in Jordan, said in a paper to the Middle East Agricultural Development Conference in Cairo in 1944, that "security of tenure is essential for the orderly progress of good farming". The difficulty is that if land settlement programmes are put into operation without some revision of the land tenure system, the large landowner, whose feudal title was not always clear, is merely confirmed in his position, so that it is not necessarily the actual farmer who obtains the security of tenure. Those applying such registration, particularly the mandatory authorities, were indeed fully conscious of this difficulty but with the best intentions were unsuccessful in finding a way round it.

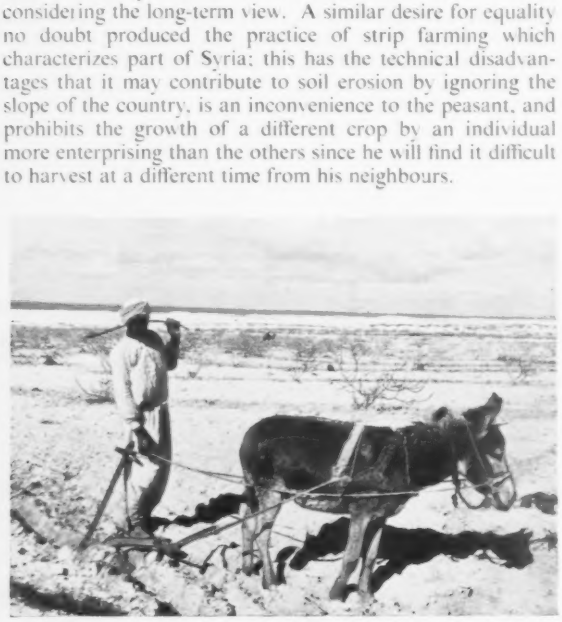
There are also, of course, many small proprietors in the Middle East; but when these hold their own land the excessive fragmentation which results from the Moslem laws of inheritance often comes into play so that holdings are progressively broken up into tiny and uneconomic pieces. In Egypt in 1951, for example, there were some 2,600,000 small landowners representing 94 per cent of the total number; of these almost two million, being 72 per cent of all landowners, held between them only 13 per cent of the total land surveyed and had less than one feddan each, two feddans being regarded as the minimum land holding for subsistence. The others held between one and five feddans each and between them accounted for 22 per cent of the total land held. All the rest of the land, being 65 per cent, was held by less than 6 per cent of the total landowners[14]. The farming of such tiny pieces not only is agriculturally unsound and insufficiently productive to maintain a decent standard of living, but often places the peasant in the power of the money-lender, "who literally supports the farmer as a rope supports the hanged".[15]

Where peasants are neither share-cropper tenants nor

* All these are exacerbated by the two great internal and external tensions—Arab-Israeli and West-East—affecting the region. But since their solution is clearly not economic and social alone, they are not discussed in this study.

† Both economic and social development are listed among the pre-requisites of true democracy in the Middle East by Charles Issawi in an essay in *International Affairs*, Jan. 1956, 32.1, p. 27.

individual proprietors, they may possess their land on the Masha'a system whereby the territory of a village is held in common, and individual ownership and cultivation are limited to a plot or plots which are rotated to give every man a chance in turn to work the bad as well as the good land. This has the disadvantage that no one will take very good care of land which is shortly to pass out of his use but instead will try to draw the maximum out of it without considering the long-term view. A similar desire for equality no doubt produced the practice of strip farming which characterizes part of Syria; this has the technical disadvantages that it may contribute to soil erosion by ignoring the slope of the country, is an inconvenience to the peasant, and prohibits the growth of a different crop by an individual more enterprising than the others since he will find it difficult to harvest at a different time from his neighbours.



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The simple plough

Another factor which has kept the Middle East poor is the low productivity of agriculture per head and per acre: nor is this eliminable merely by land reform and the building of great works. The soil itself is often infertile, for much of the earth of the Middle East lacks humus; water, even when proper provision for it has been made, may be an uncertain quantity and produce unexpected reactions (*e.g.*, salinity); the crops of the region are subject to serious insect pests and diseases; and the peasant has never been taught, and perhaps has no incentive, to use methods other than the most primitive and old-fashioned. It is true that this latter point can be over-estimated; the paradox that the shallow-digging wooden plough is sometimes preferable to the tractor-drawn deep plough, and consequently the time-honoured methods to those scientific high-pressure systems found successful in the Imperial Valley in California, has now acquired the status of a truism.* But it is not of universal application, and different methods applied after experiment, and still more the scientific development of crops and the improvement of local strains of animals (often preferable to the import of high quality cattle which cannot stand the climate) would certainly result in a substantially increased output. Nor should it be forgotten that the cultivator requires attention as well as his methods; he must not only be taught but also cured, for serious endemic diseases such as bilharzia and malaria may make him a less successful operator.

In the third place, the structure of society in the region is unbalanced; there is a small number of very rich and a large body of very poor with between them a group, as yet limited, of professional men and officials who represent the growing middle class. Such a structure, the result of various forces which have concentrated wealth into the hands of a few, is inclined to perpetuate its own inequality. The rich tend to get richer and the poor poorer because the various ills to which the latter are subject, such as illiteracy and disease, still further reduce their working and hence earning capacity. When this is coupled with lack of incentive and primitive methods we have the paradoxical but wide-spread position that the farmer is working long hours in order to produce barely enough to live on, and yet is in a sense under-employed since he cannot, or does not, work properly during these hours. Consequently "the region is backward because it is poor, but it is also poor because it is backward".[16] To break down this circle is not easy; economic development may not immediately benefit the bulk of the population owing to the land tenure and social structural deficiencies; and though lip service is paid to the establishment of State social services, there are still some Governments which do not seem to make much progress towards them. Moreover some countries even today, and most in the past, could not, even if they wished to, support expensive social services; as recently as a few years ago the financial difficulties of Iraq, for example, were acute. Today this country both has the wealth and is spending it on extensive education and health services; but countries without such revenues would be obliged in order to finance social services to increase their taxation on those groups which can bear it. That they do not do so—for direct taxation forms a very small percentage of the normal revenue of most Middle East Governments—is partly due to pressure from the wealthy groups which would be hit and partly to the well-known fact that an inefficient administrative machine always finds it easier to collect such indirect taxes as customs duties.

Nor has the development of industry compensated for the agricultural deficiencies, nor, as yet, altered the social structure to any degree. Commerce has always been more important than industry in the Middle East for the geography of the region means that trade routes must pass across it and consequently that there must be merchants. But the lack of raw materials and, in the past, of any important industrial fuel other than charcoal, have retarded industry, which has developed mostly in the form of handicrafts. As mass-produced goods from the West have come in, the latter have declined; but modern industry has not developed largely, partly owing to this competition, partly since the pre-requisite technical skills were lacking, and partly since the low purchasing power of the peasants limits the market.

Another retarding factor in the development of the region is the general inefficiency of the Government administrative machines, in many of which corruption is as yet rife. Most countries have built up a civil service; but this is generally a bureaucracy imitated from the West but lacking the financial

* "As in most parts of the East the farmer relies on a few simple implements and in this part of Arabia long experience has evolved a simple set of implements well suited to the nature of the land farmed, the capital resources of the peasant, and the draught of his oxen . . . The tillage of the soil as followed by the South Arabian is simple but effective. It aims at the conservation of moisture, the preparation of a suitable medium for plant growth and the removal of weed competition. Deep ploughing is not practised on dry land and generally soil stirring is effected to a depth of about six inches." (Paper by B. J. Hartley on "Dry Farming Methods in the Aden Protectorate", Report of Conference on Agricultural Development of the Middle East, 1944, p. 39).

Photo by courtesy of the Iraq Petroleum Co Ltd

Industry has developed mostly in the form of handicrafts.

resources or indeed the flow of work to keep itself going. The dominating position of the capital cities and the love of the educated class for the bright lights have also resulted in the administrations being over-centralized. Thus we find in most of the principal Middle East cities large bodies of Government officials, under-worked and under-paid, most of whom cannot be efficient because they cannot live on their salaries and have to give their real energies to some outside job which supplements their income. This situation, at least, may well be improving in such a country as Iraq; less easy to eliminate is the suspicion with which the average man, particularly the peasant, regards the Government. "His association with the state is practically limited to taxation, assessment, conscription, or forced labour. Hence the villager regards the Government with resentment and fear; his reactions to its representatives are inspired by self-preservation . . . When Government agents come into the village asking silly questions, they get silly answers . . . This is in part responsible for the well-known unreliability of Near Eastern statistical information".[17]

The final factor is one which is in process of being altered by the acquisition of oil wealth: this is the difficulty found in the past in raising capital locally for productive investment. The man of wealth in the Middle East finds the returns from industrial enterprise, for example, often too small and too slow for his liking; he prefers the more dangerous, but more profitable, quick and high receipts which result from short-term loans or the exploitation of land; and because the area is poor both the supply of and the demand for capital for any purpose are in any case limited. The fact is that in the Middle East, as elsewhere, poverty is a vicious circle; in terms of economic theory this has been expressed by Nurkse:[18] "On the supply side, there is the small capacity to save, resulting from the low level of real income. The low real income is a reflection of low productivity, which in its turn is due largely to the lack of capital. The lack of capital is a result of the small capacity to save, and so the circle is complete. On the demand side, the inducement to invest may be low because of the small buying power of the people." But now that the whole economy is becoming wealthier in certain countries as a result of the spending of the oil revenues, it should clearly not be impossible to break this circle and raise capital for large public or private undertakings, not merely directly from these revenues but from private investment.

References

[1] Fisher, W. B. "The Middle East—A Physical, Social, and Regional Geography", p. 3.
[2] "Economic Development in the Middle East, 1945-1954". United Nations.
[3] Fisher, W. B. "The Middle East—A Physical, Social, and Regional Geography", p. 5.
[4] Warriner, D. "Land and Poverty in the Middle East".
[5] Mackinder, Sir H. J. "Democratic Ideals and Reality".
[6] Jackh, E., in "Background of the Middle East". Edited by E. Jackh, p. 18.
[7] Fisher, S. N., in "Social Forces in the Middle East". Edited by S. N. Fisher, p. 44.
[8] Huntington, E. "Civilization and Climate", third Edition, pp. 7 and 8. Also "The Pulse of Asia".
[9] Fisher, W. B. "The Middle East—A Physical, Social and Regional Geography".
[10] "The Middle East, a Political and Economic Survey", second Edition, p. 165. Royal Institute of International Affairs. London. 1954.
[11] *Ibid.*, p. 220.
[12] Murray, K. A. H., in Report of Conference on Agricultural Development of the Middle East. 1944. pp. 197, 198.
[13] Fisher, W. B. "The Middle East—A Physical, Social, and Regional Geography", p. 7.
[14] "The Middle East, a Political and Economic Survey", second Edition, p. 224. Royal Institute of International Affairs. London. 1954.
[15] Ali, Anwar, in "The Evolution of Public Responsibility in the Middle East", Middle East Institute, p. 15.
[16] Holme, C., in "Petroleum Times Review of Middle East Oil". Edited by C. T. Barber, p. 102, 1948.
[17] Crary, D. D., in "Social Forces in the Middle East". Edited by S. N. Fisher, p. 54.
[18] Nurkse, R. "Problems of Capital Formation in Under-developed Countries", p. 5.

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WORKS TRAINING IN CHEMICAL ENGINEERING

In response to many enquiries for guidance on the practical training of apprentices in the chemical engineering profession, the Institution of Chemical Engineers has prepared a "Note on the Works Training of Student Apprentices in Chemical Engineering".

This note does not attempt to lay down rules, but merely to be a guide to be considered in regard to local conditions. It suggests the number of months which shall be devoted to various subjects in a 5-year period.

Copies of the leaflet are obtainable from the Institution of Chemical Engineers, 56 Victoria Street, London, S.W.1., and the Education Committee of the Institution has expressed its readiness to give advice in special cases and to receive constructive criticism. The Institution also publishes its views on the college training of chemical engineers in its publication "A Scheme for a Part-time course in Chemical Engineering", copies of which are obtainable from the Institution, price 2*s*. post free.

Around the Branches

BAHRAIN, FAWLEY, KUWAIT, LONDON, NORTHERN, SCOTTISH, SOUTH-EASTERN, SOUTH WALES, STANLOW, TRINIDAD

Fawley Branch Annual Dinner

The Annual Dinner of the Fawley Branch was held at the Westcliff Hall Hotel, Hythe, on 9 December 1955. The Branch was honoured by the presence of the Deputy Mayor of Southampton, Alderman R. H. Hammond, O.B.E., J.P., who, in reply to a welcome accorded him by Dr F. Mayo (refinery manager), reviewed the growth of industry on the west side of Southampton Water. He emphasized the urgent need for a modern road to carry the present traffic in place of the existing country lane which stretches from Totton to Fawley, a distance of some 10 miles.

The dinner was followed by an entertainment given by Wizard Beal, who provided some very clever illusions, and some musical items by Dr R. T. W. Hall were greatly appreciated.

London Branch

A paper entitled "Operation of a Tanker Fleet" was presented to the London Branch by C. A. Samuels on 22 November.

In his opening remarks Mr Samuels emphasized the importance of ocean-going tankers, saying that at the beginning of 1955 there were 39 million dw tons trading and a further 9 million dw tons building, representing 25 to 30 per cent of the world's cargo shipping.

After describing the various loading marks for different world zones Mr Samuels described the deadweight of a tanker as the weight carried when loaded to Summer marks, and the displacement as the deadweight plus the lightweight, or weight of the ship.

Dealing with the design of a tanker, Mr Samuels described some of the requirements which have to be considered. It was, he said, of extreme importance that the cargo tanks should be designed to allow change of volume with variations of temperature and to restrict any movement of the cargo which might endanger the trim of the ship. He then illustrated several different methods of designing cargo tanks and their expansion chambers.

Other requirements mentioned included fire precautions, provision for heating tanks, and pumping arrangements. Pumps and pipelines had to be so arranged, said Mr Samuels, that they could fill and discharge cargoes and also pump sea water for both tank cleaning and ballast. Reviewing the world tanker fleets, Mr Samuels said that 30 per cent was owned by the oil companies or their subsidiaries, the balance being on long- or short-term charter. Tramp tonnage was convenient to cover market requirements. The way conditions could change was illustrated by the fact that before 1939 tankers were mainly engaged in carrying finished

(Right) *Dr F. Mayo (refinery manager) welcoming the guest of the evening, Alderman R. H. Hammond*

(Left) *Alderman R. H. Hammond Deputy Mayor of Southampton, addressing the gathering*

A general view of the Fawley Branch Annual Dinner

products from refineries to world markets, whilst today, when refineries were situated in areas of major consumption or optimum convenience, the largest proportion of tankers carry crude to the refineries.

The general trade today was split into clean oils, including gasoline; kerosine and lighter gas oil; and black oils, including crudes and heavy gas oil. Owing to the elaborate cleaning arrangements needed when changing from one class to another, vessels generally carried on one trade for long periods. In addition to these two main trades there were, of course, tankers engaged in the carriage of lubricants and petroleum chemicals.

For efficient operation of a fleet, essential services must be budgeted for in advance as tankers frequently loaded where supplies were not available, for example, when loading off-shore from sea lines. Crew conditions had to be considered and provision made for personal mail.

Mr Samuels then dealt with maintenance and said that it was common practice to wash tanks at sea during ballast passage and to discharge washings at least 100 miles from shore. He described loading precautions to avoid contamination and fire hazards and gave details of some of the Master's responsibilities in port. These included payment of crew, customs documents, signing on of new crew, stores, liaison with port authorities, and a host of other details, which generally had to be dealt with in 36 hours.

In tanker operation communications were of importance, said Mr Samuels. These included short wave radio contact with head office and V.H.F. telephones in communication with loading and discharging ports. Contact was made with the port of arrival 48 hours previous to arrival and after that constant contact was kept.

As maintenance had to be kept to a minimum, vessels were programmed to fit into docking schedules of 8 to 12 months according to the ship and type of trade.

After an enthusiastic discussion, a vote of thanks was carried by the 135 members and visitors present.

Film Evening

The Mezzanine Cinema at Shell-Mex House was filled to capacity on 16 December, 1955, when the London Branch held their annual Film Show. So great had been the number of applications for tickets that many had had to be refused. However, the honorary secretary of the Branch, R. F. Leach, in welcoming the members on behalf of Shell-Mex and BP Ltd and the Branch Committee, was able to announce that a repeat show would be held on 3 February 1956.

Each of the films shown had a story to tell, and in each case the telling of that story held the audience throughout. The first, an Esso production, was *Highways for Tomorrow*, based on a phrase recently used by H.R.H. The Duke of Edinburgh that "congested roads are slowly stifling commercial communication". Shots of actual road conditions in Great Britain emphasized the importance of the problem and the need for immediate action if Britain is to maintain its position in commerce and industry. Final shots taken in the U.S.A. and on the Continent showed what could be done.

For the second film, *The New Explorers*, a British Petroleum production in Eastman colour, had been chosen. It gave a fascinating account of oil exploration throughout the world, from the hot arid deserts of the Middle East to the icy north of Canada. The progress of negotiations in Abu Dhabi, seismic operations in Zanzibar, under-water drilling in the Caribbean, and operations in Papua were all illustrative of the widely varying conditions under which the unceasing exploration for oil goes on.

The Rival World, a Shell film in Eastman colour, was the third to be shown. It showed how man is constantly battling with the insect world for his survival, and illustrated how insects bring death and disease, and devour one-third of the food grown by man. To master the rival world, organized control is essential and means of attaining this were shown.

At the conclusion of the films, W. H. Davies, chairman of the Branch, proposed a vote of thanks to Shell-Mex and BP Ltd for the use of the cinema and for the provision of refreshments later, and to the three companies who had made these most interesting films available. The vote of thanks was carried with acclamation and the meeting adjourned to the restaurant for refreshments.

Scottish Branch

On 15 December a talk on "Off-shore Drilling" was given by B. F. Saurin. The speaker introduced the subject by referring to the drilling operations now being carried out for the National Coal Board in the Firth of Forth, off Kirkcaldy. This, he said, was an example of a desire to follow a known coal-bearing stratum out under the sea; off-shore drilling for oil had often originated in a similar desire to follow a series of oil-bearing structures beyond the shoreline. Another motive was provided in some cases by a desire to determine whether reserves of oil existed in certain submarine areas, where they could be exploited at a later stage of the general development of the industry. Off-shore drilling was in general a very expensive operation but there was a possibility that, in certain parts of the world, the exploitation of marine oilfields might be more economical than was the case on land.

Taking a drilling rig to sea was, of course, a difficult and interesting operation involving a combination of oil drilling with civil engineering and seamanship. Outstanding among the problems to be dealt with were the design of platforms to support the drilling rigs safely above the highest possible storm waves and the provision of the necessary facilities to keep men healthy and happy at work miles away from the shore.

Typical off-shore drilling operations were illustrated by lantern slides and the speaker pointed out that, although the platforms might stand 50 ft out of water, the proportion of their bulk below the waves was even

THE BRANCHES COMMITTEE IN SOUTH WALES

The last meeting of the IP Branches Committee was held in South Wales. Here (left) *are seen the members' wives at Langland Bay before leaving for a trip in mid-Wales. Prior to the Committee meeting, other members paid a visit to the oil dock* (right).

more remarkable. Instances were known where it had been necessary to drive piles between 300 and 400 ft long to obtain adequate support in a soft sea bottom. These platforms had developed by degrees from the original simple wooden-piled structures, and special methods of construction, in particular the template method in which all the piles were driven through a large steel jig standing on the sea bottom, had been built up in course of time. There had, however, also been a parallel development from the marsh barges used in the Louisiana swamps. These were really drilling rigs mounted on pontoons for use in an area where the very soft ground conditions made this the only practicable method of moving heavy equipment. It had been a natural development to try using marsh barges in very shallow water at the edge of the sea, and later special vessels were built. These had a platform, carrying the drilling equipment, mounted on stilts 40 or 50 ft high on a pontoon which was used to float the assembly into position and then scuttled. It then rested on the sea bed while supporting the platform well above the water. Further developments had led to the modern mobile platform which had an area of about half an acre and could float itself into position and then lower its columns or legs into the sea bottom and finally climb up them until it was 40 ft or so clear of the water.

The speaker reminded the audience that, just as in the case of a platform there was very often much more work below the surface than above, so in the same way the whole off-shore drilling operation rested on a very wide base of administrative and planning activities. The decision to drill could be made only after the exploration area had been covered by a series of examinations such as gravity and seismic surveys, each of which was quite a complex enterprise in itself. The planning of the drilling operation then required two or three years' work on survey, planning, and design of working bases, platforms, telecommunications, sea transport, and other auxiliary services, not to mention the administrative arrangements for the provision of suitable staff qualified to undertake the heavy responsibilities involved in this very specialized type of work.

The address concluded with a description of the special problems of off-shore drilling in the southern part of the Persian Gulf where no oilfield services existed, the general facilities were extremely meagre, the climate oppressive and, in fact, all the circumstances combined to make an off-shore drilling project an exceedingly difficult one.

South Eastern Branch

A meeting was held at the Cat and Cracker Hotel, Isle of Grain, on 29 November, when a programme of films was shown. The choice of venue was in accordance with the Branch policy of exploring surrounding areas in an effort to increase membership.

On 5 December the Branch held a general meeting at the King's Head Hotel, Rochester, when A. D. Butchart gave a talk entitled "The Important End of the Pipeline". Mr Butchart, sales manager of a well-known local motor agency, gave an outline of the present pattern of trade and trading agreements affecting the retailing of motor spirits and lubricating oils and contrasted these with the position before the second world war.

Mr Butchart emphasized that the sellers of new cars and the service stations had a great influence on the motorist's choice of products, more particularly in the case of lubricants. In addition, the growing tendency for regular servicing and oil changing to be accepted without question by the operator as good for his car had led to a considerable increase in lubricating oil sales.

The increase in motor spirit sales, however, was not so marked. This was attributable to the increasing proportion of cars with relatively small high-efficiency engines, the restrictive effect of taxation on motor spirit, and the fact that the average mileage run by motorists

was still on the low side. The last two factors could be coupled together as the basis for an appeal that the high income reaped from taxation should be "ploughed back" into improved roads.

A very interesting discussion followed, during which Mr Butchart dealt with questions ranging from the inevitable "Why can I not have my windscreen cleaned every time I buy a gallon of petrol?", to the effect of the introduction of "multi-grade" lubricating oils.

Stanlow Branch

A symposium of three papers on refinery utilities was presented at a meeting of the Branch held at the Grosvenor Hotel, Chester, on 16 November.

The papers were: "Water", given by G. W. Power of Lobitos Oilfields, "Electrical Power", by W. S. Morris of "Shell" Refining and Marketing Co Ltd, and "Steam", by D. W. Smith, also of "Shell" Refining and Marketing Co Ltd.

There was a lively discussion followed by a vote of thanks from the chair.

Joint Meeting

A joint meeting with the Liverpool and North West Section of the Royal Institute of Chemistry was held at the Grosvenor Hotel, Chester, on 14 December, when G. R. Storey of "Shell" Refining and Marketing Co Ltd gave a lecture on "The Shell Hydrodesulphurization Process".

After a brief introduction illustrating the general mechanism of the hydrodesulphurization process, the lecturer went on to deal with the new Shell method specifically.

He pointed out that the process operated at temperatures from 690°-720° F and pressures of 600-700 p.s.i.g. and gave desulphurization in the range of 85-90 per cent, using as catalyst cobalt-molybdenum oxides supported on bauxite or alumina.

A short résumé of the Shell process used in the U.S.A. for the desulphurization of naphthas, and the Autofining process of the British Petroleum Co Ltd, was then given.

Mention was also made of the Gulf process, still in the pilot plant stage, where heavy residues and crudes could be processed. The heavy residues yield from Kuwait crude by conventional distillation was in the region of 49·4 per cent, with a sulphur content of 4·11 per cent, said Mr Storey, whereas by the new process the yield was 20·4 per cent, with a sulphur content of 0·84 per cent.

Discussion was opened by P. H. Daniels of "Shell" Research Ltd, the vote of thanks being given by Dr J. B. Matthews, also of "Shell" Research Ltd, and Chairman of the Liverpool and North West Section of the RIC.

South Wales Branch

A meeting of the South Wales Branch held at the Training Centre, National Oil Refineries Ltd, Llandarcy, on 1 December, 1955, took the form of a Brains Trust. The members of the Brains Trust were J. K. Anthony, A.S.A.A., A.C.W.A.; F. V. M. Bell, M.E., A.M.I.C.E.; D. W. Thomas, B.E.M., and L. S. Thornes, A.R.C.S., Ph.D., with P. F. Ellis, M.E.E., B.Sc., as chairman.

A wide range of questions was discussed, including the use of radio-active isotypes, the advent of the turbo-jet motor car, the possibility of reducing the price of petrol, fire fighting media, and the incidence of tanker explosions.

The panel dealt most competently and interestingly with the questions and the meeting was conducted in a pleasantly informal atmosphere.

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New IP Publications

Recent publications of the Institute are:

Molecular Spectroscopy

This publication of the Proceedings of the Conference on Molecular Spectroscopy, organized by the Hydrocarbon Research Group of the Institute of Petroleum and held in London on 28 and 29 October 1954, contains the nineteen papers presented together with the ensuing discussions. The subject matter covers nearly the whole field of molecular spectroscopy, the emphasis being as far as possible on the newer techniques and developments both in instrumentation and application. In addition, two periods were devoted to discussions on the documentation and filing of spectra and the main items arising out of these discussions are also recorded. All the papers are well referenced. The price is 2 guineas post free.

Standard Methods for Testing Petroleum and its Products

The 15th edition of the Institute's standard methods handbook contains seven new methods, one of which (Copper corrosion by petroleum products, IP 154/56) replaces the previous method IP 64/53. The other new methods are Hydrocarbon Types in Liquid Petroleum Products—Fluorescent Indicator Adsorption Method, IP 156/56T; Oxidation Test for Turbine Oil—TOST Method, IP 157/56; Rust Preventing Characteristics—Temporary Corrosion Preventives, IP 153/56T; Sulphur (Reactive to Copper) in Cutting Oils, IP 155/56; and two methods for spectrophotometric analysis, the first for benzene and toluene, IP 151/56T, and the second for ethyl benzene p-, m-, and o-xylenes, IP 152/56T.

Twenty-one existing methods have been revised technically or have been subjected to major editorial changes, and revisions have been made in regard to some of the thermometer specifications. Two methods have been withdrawn, the first being IP 64/53, which is replaced by IP 154/56 as mentioned above. The other is IP 65/53 for corrosive sulphur in motor fuel by the reaction with copper bronze.

Copies of this publication are obtainable at £2 post free, members of the Institute being entitled to receive one copy at 35*s*.

Other Publications

Members of the Institute are reminded that the Institute has available a number of books on the science and technology of petroleum, and a full list is obtainable on application.

World Petroleum Statistics*

The percentage increase in the world production of crude petroleum in 1954 was not so great as the percentage increase in 1953. Production in 1954 totalled 4991 million barrels—an increase of 4·6 per cent over 1953, whilst production in 1953 showed an increase of 6 per cent over 1952.

The four tables reproduced here from the report give details of crude oil supply and demand, production of major refined products, estimated domestic demand for major products in those countries where reasonably complete figures are available, and bunker oil deliveries. In compiling Table III demand has been calculated in most instances by the following formula: refinery production (including fuel oils consumed in the refineries), plus imports, minus exports, and plus or minus changes in inventories in those few countries where inventories were known. Loadings of bunker fuels in vessels or airplanes engaged in international trade are included in the demand of countries where the loadings occurred, and are not classified as exports.

**World Petroleum Statistics*—1954, prepared by J. V. Hightower, commodity-industry analyst, under the direction of H. J. Barton, Branch of Petroleum Economics, Division of Petroleum, U.S.B.M., WPS No. 79.

Definitions

Motor fuel—Includes aviation gasoline, other gasolines and naphtha from crude and natural gasoline, and blended alcohol or benzol.

Kerosine—Includes all grades of kerosine for power, lighting, and heating.

Distillate fuel oil—Includes gas oil, light diesel oil, and light heating oils.

Residual fuel oil—Includes blends of distillate and residual oil in which residual is known to predominate.

Lubricating oil—Includes all grades of lubricating oil and oils used in grease manufacture.

During 1954, statistics on aviation jet fuel were too scarce to warrant tabulations of the production of and demand for that product. In Table II (production of major refined products) the quantities of jet fuel that were known with sufficient accuracy are included in motor fuel as indicated in the table. In Table III (demand) jet fuel has not been knowingly included in motor fuel or kerosine.

TABLE I
WORLD SUPPLY AND DEMAND—CRUDE PETROLEUM—1954
(Thousands of barrels)

Country	*Production*	*Imports*	*Exports*	*Crude runs to stills*	*Other demand and losses*	*Stock change*
NORTH AMERICA						
Canada	96,065	76,772	2,345	168,507	490	1,495
Cuba	25	3,380	—	3,125	—	280
Mexico*	83,653	—	4,597	73,810¶	5,000**	246
United States	2,316,323	239,479	13,564	2,539,564	18,734	−16,060
Total	2,496,066	319,631	20,506	2,785,006	24,224	−14,039
Daily Average	6,839	876	56	7,630	66	−37
SOUTH AMERICA AND CARIBBEAN						
Argentina	29,650	27,300¶	—	55,830¶	120	1,000
Bolivia	1,695	—	57	1,565	14	59
Brazil	992	2,357	—	2,380	12	957
Chile	1,736	386	1,100	770	12	240
Colombia	40,547	—	28,127	10,846	799	775
Ecuador	3,146	—	1,337	1,920	22	−133
Neth. Antilles†	—	264,857	—	266,919	—	−2,062
Peru	17,161	124	2,133	14,554	52	546
Trinidad	23,629	16,658	3,066	37,260	60	−99
Uruguay	—	8,626	—	8,841	—	−215
Venezuela	691,812	—	528,651	161,069	1,325	767
Total	810,368	320,308	564,471	561,954	2,416	1,835
Daily Average	2,220	878	1,546	1,540	7	5
WESTERN EUROPE						
Belgium	—	28,970	—	29,006	—	−36
Denmark	—	232	—	189	—	43
France	3,599	174,309	—	176,136	30	1,742
Western Germany	19,008	43,973	—	63,681	31	−731
Italy and Trieste	535	116,070	—	117,295	10	−700
Netherlands	6,518	70,310	—	77,542	41	−755
Norway	—	508	—	552	—	−44
Portugal	—	5,287	—	5,636	—	−349
Spain	—	13,278	—	13,223	—	55
Sweden	—	12,727	—	12,400¶	—	327
United Kingdom	450	196,539	—	196,800	35	154
Total	30,110	662,203	—	692,460	147	−294
Daily Average	82	1,814	—	1,897	—	−1

TABLE I
WORLD SUPPLY AND DEMAND—CRUDE PETROLEUM—1954—(CONT.)
(Thousands of barrels)

Country	Production	Imports	Exports	Crude runs to stills	Other demand and losses	Stock change
MIDDLE EAST						
Aden	—	10,694	—	10,090	—	604
Bahrain Island	10,992	67,458	—	78,148	55	247
Egypt‡	13,774	3,598	—	17,102	67	203
Iran	22,400¶	—	3,600¶	18,500**	120	180
Iraq	228,432	—	220,491	6,450¶	815¶	676
Israel	—	7,172	—	7,165	—	7
Kuwait	347,319	—	336,315	10,573	238	193
Lebanon	—	4,084	—	4,084	—	—
Neutral Zone	5,934	—	5,706	—	48	180
Qatar	36,450	—	35,816	—	50	584
Saudi Arabia	347,845	—	268,093	79,842	653	−743
Turkey	399	—	—	85	270	44
Total	1,013,545	93,006	870,021	232,039	2,316	2,175
Daily Average	2,777	255	2,384	636	6	6
OTHER ASIA						
China	3,000**	—**	—**	2,980**	20**	—
Formosa	35	3,025	—	3,286	—	−226
India, Burma, and Pakistan	5,489	3,869	—	9,123	30	205
Japan	2,093	46,647	—	47,070	24	1,646
Total	10,617	53,541	—	62,459	74	1,625
Daily Average	29	147	—	171	—	5
OTHER AFRICA						
Algeria	570	—	561	—	5	4
Canary Islands	—	9,601	—	9,525	—	76
French Morocco	881	—	—	863	6	12
Union of South Africa	—	5,638	—	5,242	—	396
Total	1,451	15,239	561	15,630	11	488
Daily Average	4	42	2	43	—	1
OCEANIA						
Australia	—	14,576	—	14,841	—	−265
British Borneo	36,377	—	39,799	92,268	600	580
Indonesia§	83,477	13,393				
Philippines	—	1,659	—	1,258	—	401
Total	119,854	29,628	39,799	108,367	600	716
Daily Average	328	81	109	297	1	2
TOTAL ABOVE COUNTRIES	4,482,011	1,493,556	1,495,358	4,457,915	29,788	−7,494
Daily Average	12,279	4,092	4,097	12,213	82	−21
USSR AND EASTERN EUROPE						
USSR (including Sakhalin)	419,000**	—**	3,000¶	411,400**	4,600**	—
Other Eastern Europe	89,800¶	3,300	—**	92,200**	900**	—
Total	508,800	3,300	3,000	503,600	5,500	—
Daily Average	1,394	9	8	1,380	15	—
WORLD TOTAL	4,990,811	1,496,856	1,498,358	4,961,515	35,288	−7,494
Daily Average	13,673	4,101	4,105	13,593	97	−21

*Mexico production figure is crude and distillate.

†Netherland Antilles crude import is net, excluding 14,142,000 barrels re-exported.

‡Egypt imports include 1,217,000 barrels topped crude.

§Includes New Guinea production, 4,045,000 barrels.

‖Imports from other than British Borneo.

¶Partly estimated.

**Estimated.

TABLE II

PRODUCTION OF MAJOR REFINED PRODUCTS BY COUNTRIES—1954* (Thousands of barrels)

Country	*Motor fuel*†	*Kerosine*	*Distillate fuel oil*	*Residual fuel oil*	*Lubricating oil*	*Total major products*
NORTH AMERICA (Total)	1,405,095	139,883	584,520	495,095	55,209	2,679,802
Canada	71,925	9,979	36,293	35,931	1,590	155,718
Cuba	918	699	899	407	26	2,949
Mexico	16,550	6,900‡	5,050‡	42,000‡	350‡	70,850
United States	1,315,702	122,305	542,278	416,757	53,243	2,450,285
SOUTH AMERICA AND CARIBBEAN (Total)	102,983	41,801	91,444	322,079	3,874	562,181
Argentina	13,720‡	6,360‡	7,500‡	23,500‡	700‡	51,780
Bolivia	668	127	194	533	—	1,522
Brazil	890§	115§	250§	960§	—	2,215
Colombia	2,862	601	986	6,330	64	10,843
Chile	253	69	223	3	—	548
Ecuador	653	185	347	717	—	1,902
Neth. Antilles	44,455	21,758	42,160	165,292	2,030	275,695
Peru	5,757	2,259	2,560	4,658	81	15,315
Trinidad	8,821	3,616	5,925	16,739	—	35,101
Uruguay	1,942	1,150	1,136	4,445	—	8,673
Venezuela	22,962	5,561	30,163	98,902	999	158,587
WESTERN EUROPE (Total)	185,471	33,999	139,528	278,933	11,995	649,926
Belgium	7,108	1,189	5,688	12,645	75	26,705
Denmark	—	—	44	12	—	56
France	48,269	3,531	33,804	68,419	3,409	157,432
Western Germany	24,160	353	17,076	10,696	2,811	55,096
Italy and Trieste	24,293	7,773	23,551	55,602	875	112,094
Netherlands	20,498	5,044	20,621	31,768	384	78,315
Norway	94	—	137	35	91	357
Portugal	1,391	842	1,115	2,006	—	5,354
Spain	2,999	495	2,619	6,259	—	12,372
Sweden	1,761	911	2,899	5,890‡	171	11,632
United Kingdom	54,898	13,861	31,974	85,601	4,179	190,513
MIDDLE EAST (Total)	46,151	21,301	41,194	111,731	—	220,377
Aden	1,075	333	1,273	5,528	—	8,209
Bahrain Island	19,626	8,371	13,839	32,634	—	74,470
Egypt	1,887	1,705	1,582	10,955	—	16,129
Iran	4,160§	2,570§	2,350§	8,380§	—	17,460
Iraq	1,030‡	940‡	470‡	3,750‡	—	6,190
Israel	1,448	1,095	1,326	2,836	—	6,705
Kuwait	383	101	1,983	7,784	—	10,251
Lebanon	1,010	527	708	1,814	—	4,059
Saudi Arabia	15,526	5,659	17,636	38,050	—	76,871
Turkey	6‡	—	27‡	—	—	33
OTHER ASIA (Total)	16,771	5,036	10,521	23,504	2,324	58,156
China	1,000§	200§	300§	1,200§	—§	2,700
Formosa	855	568	545	1,124	—	3,092
India, Burma, and Pakistan	2,282	1,033	1,676	2,592	177	7,760
Japan	12,634	3,235	8,000	18,588	2,147	44,604
OTHER AFRICA (Total)	4,161	797	3,353	5,582	—	13,893
Algeria	—	—	—	—	—	—
Canary Islands	1,848	602	2,195	3,849	—	8,494
French Morocco	221	93	244	262	—	820
Union of South Africa	2,092	102	914	1,471	—	4,579
OCEANIA (Total)	28,055	11,074	30,571	28,441	206	98,347
Australia	6,921	6	2,872	3,793	206	13,798
Indonesia and British Borneo	20,726	10,976	27,521	24,314	—	83,537
Philippines	408	92	178	334	—	1,012
TOTAL ABOVE COUNTRIES	1,788,687	253,891	901,131	1,265,365	73,608	4,282,682
Daily Average	4,901	696	2,469	3,467	202	11,735

*From crude petroleum, natural gasoline blended and oils rerun. †Motor fuel includes the following known amounts of jet fuel (1,000 barrels) in these countries: Canada, 1,616; United States, 46,550; France, 2,608; Germany, 1,465. ‡Partly estimated. §Estimated.

TABLE III

ESTIMATED DOMESTIC DEMAND FOR MAJOR PRODUCTS—1954 (Thousands of barrels)

Country	*Motor fuel*	*Kerosine*	*Distillate fuel oil*	*Residual fuel oil*	*Lubricating oil*	*Total major products*
NORTH AMERICA AND CARIBBEAN						
Alaska and Hawaii	4,560	130	3,580	5,420	120	13,810
Canada	73,922	12,085	47,020	45,380	2,480	180,887
Central America	2,685	534	3,204	5,100	65	11,588
Cuba	5,100	699	2,050	10,050	175	18,074
Mexico	20,690	7,150	7,080	27,000	800	62,720
Puerto Rico	2,890	730	270	3,160	55	7,105
United States	1,238,346	118,260	526,369	522,099	38,444	2,443,518
West Indies, other	2,950	526	9,881	36,840	150	50,347
SOUTH AMERICA						
Argentina	14,100	6,460	9,000	33,750	1,040	64,350
Bolivia	620	119	205	520	9	1,473
Brazil	23,230	4,175	9,418	19,900	1,320	58,043
Chile	3,198	1,161	1,426	5,023	184	10,992
Colombia	6,485	1,346	1,601	3,290	174	12,896
Ecuador	930	195	356	870	33	2,384
Paraguay	330	75	130	76	10	621
Peru	4,395	1,686	1,449	4,710	115	12,355
Uruguay	2,023	1,155	1,265	4,750	78	9,271
Venezuela	10,415	2,888	5,599	14,300	227	33,429
WESTERN EUROPE						
Belgium and Luxemburg	8,468	1,091	7,650	8,940	675	26,824
Denmark	5,390	840	4,392	7,493	321	18,436
Finland	2,890	590	1,950	1,720	175	7,325
France	34,950	757	22,110	54,900	2,870	115,587
Germany, West	21,522	377	22,314	16,495	3,067	63,775
Greece	2,110	740	2,375	4,790	135	10,150
Iceland	395	25	682	710	28	1,840
Ireland	2,370	911	765	1,910	132	6,088
Italy and Trieste	11,550	1,740	12,414	47,900	990	74,594
Netherlands	7,250	1,790	10,300	17,100	650	37,090
Norway	2,815	340	5,650	6,810	290	15,905
Portugal	1,450	1,195	2,390	3,620	120	8,775
Spain	4,510	680	3,890	7,770	510	17,360
Sweden	9,575	3,580	16,390	17,120	600	47,265
Switzerland	4,085	365	5,780	1,870	235	12,335
United Kingdom	57,790	10,550	38,900	67,750	5,820	180,810
MIDDLE EAST						
Bahrain	218	81	1,740	6,870	14	8,923
Iraq	1,250	1,290	570	3,550	100	6,760
Israel	1,460	1,180	1,206	3,900	90	7,836
Jordan	240	200	120	80	10	650
Kuwait	378	107	286	7,640	4	8,415
Saudi Arabia	1,125	290	2,510	10,500	25	14,450
Syria-Lebanon	1,910	750	1,800	1,810	60	6,330
Turkey	2,980	1,770	2,310	350	370	7,780
OTHER ASIA						
Burma	600	300	300	200	60	1,460
Ceylon	1,100	600	1,200	2,600	50	5,550
Formosa	900	400	1,000	900	60	3,260
India	8,200	10,000	5,850	6,200	1,050	31,300
Indo-China	3,000	380	600	700	150	4,830
Japan	15,100	2,990	7,700	33,700	2,400	61,890
Malaya	3,050	300	5,780	12,990	150	22,270
Pakistan	1,600	1,400	1,600	4,500	200	9,300
Thailand	1,700	650	1,400	500	120	4,370
AFRICA						
Algeria	2,180	600	2,100	5,400	140	10,420
Angola	340	40	200	60	30	670
Belgian Congo	1,450	220	900	20	130	2,720
Cameroons, French	400	100	100†	N.A.	20	620
Egypt	2,850	6,160	4,300*	19,500*	250	33,060
Ethiopia	330	50	60	20	30	490
Kenya	850	300	3,500†	N.A.	50	4,700
Liberia	170	60	40	—	5	275
Madagascar	400	95	160	30	40	725
Morocco, French	3,030	439	1,000	1,650	133	6,252

TABLE III

ESTIMATED DOMESTIC DEMAND FOR MAJOR PRODUCTS—1954—(CONT.) (Thousands of barrels)

Country	Motor fuel	Kerosine	Distillate fuel oil	Residual fuel oil	Lubricating oil	Total major products
Nigeria	1,500	400	300	100	50	2,350
Rhodesia	1,517	291	500†	N.A.	100	2,408
Sudan	550	130	330	650	30	1,690
Tanganyika	450	150	460†	N.A.	30	1,090
Tunisia	1,293	277	690	1,372	51	3,683
Uganda	390	130	180†	N.A.	30	730
Union of South Africa	10,900	3,950	3,600	2,750	750	21,950
OCEANIA						
Australia	24,181	3,688	7,950	8,995	1,295	46,109
Indonesia	4,600	4,661	4,018	4,755	220	18,254
New Zealand	6,070	190	1,910	2,070	210	10,450
Philippine Islands	4,600	1,420	2,810	3,350	270	12,450
TOTAL ABOVE COUNTRIES	1,706,851	230,984	858,935	1,156,848	70,874	4,024,492
Daily Average	4,676	633	2,353	3,169	194	11,025

* Includes transit trade in ship bunkers.
† Includes any residual fuel, quantities not available.

TABLE IV

BUNKER OIL DELIVERIES TO VESSELS ENGAGED IN INTERNATIONAL TRADE—1954

(Thousands of Barrels per day)

Zone	Bunker distillate	Bunker residual	Total bunker oils	Zone	Bunker distillate	Bunker residual	Total bunker oils
U.S.A. (continental)	24·6	171·0	195·6	Middle East, including Egypt, Red Sea, and Persian Gulf	26·9	91·0	117·9
Canada	2·1	14·3	16·4	South and East Africa	3·7	10·6	14·3
Central and South America	11·9	37·8	49·7	India, Burma and Ceylon	1·8	11·9	13·7
West Indies	33·7	91·6	125·3	East and South Asia, including Indonesia and Japan	15·9	52·5	68·4
West Africa	12·4	20·5	32·9	Australasia	3·9	12·6	16·5
United Kingdom and Eire	19·4	63·2	82·6				
North Europe, including French and Atlantic ports	30·4	50·0	80·4	Total above	210·3	679·9	890·2
Mediterranean, including Spain and Portugal	23·6	52·9	76·5	Total above excluding U.S.A.	185·7	508·9	694·6

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COUNCIL COMMENTARY

All members will be extremely interested to learn that at the Council meeting held on 14 December 1955, Col S. J. M. Auld announced that Lord Geddes had been invited to be our next President. Lord Geddes' experience of petroleum matters, his energy, and drive, are well known to many of us and the Institute can count itself as extremely fortunate to have so notable a figure at the helm.

Col Auld also announced that he had been invited to join the Scientific Advisory Council of the Ministry of Fuel and Power—no small honour to be accorded to our retiring President. He has also been elected a member of the BSI Executive Committee.

To offset these notable items Mr Masterson has, much to his regret, found it necessary to resign the chairmanship of the Finance Committee.

Dr E. B. Evans described the recent activities of the Publications Committee and reviewed the progress which had been made in the planning of the next Summer Meeting which, incidentally, bids fair to be the best ever.

The final drafting of the third edition of the IP Electrical Code is practically complete. The main alteration to the Code covers the extension of the concept of "remotely dangerous areas" which in the previous code related only to oilfields. This concept will now include conditions to be found in refineries and marketing installations and recommendations are made with regard to suitable electrical equipment for use in such areas. It is of interest to note that these recommendations are in line with the trend in America where a recent publication of "API Recommended Practice for Classification of Areas for Electrical Installations in Petroleum Refineries" includes a conception of remotely dangerous areas. The conclusions of the Engineering Committee were arrived at quite independently of the API. The Committee hopes that its recommendations will continue to have the support of all members.

Her Majesty's New Year Honours

Sir Frederick Godber

Barony

Sir Frederick Godber, chairman, "Shell" Transport and Trading Co Ltd. Sir Frederick's entire career has been spent in the oil industry, which he joined in 1904. After ten years in the U.S.A., from 1919 to 1929, Sir Frederick returned to the U.K. to become a managing director of the Royal Dutch/Shell Group—a position which he held until 1946 when he became chairman of the "Shell" Transport and Trading Co Ltd.

During the second world war Sir Frederick was chairman of the Overseas Supply Committee of the Petroleum Board and was knighted in 1942 for his services to the allied cause.

K.B.E.

Sir Claude Dixon Gibb, C.B.E., chairman, C. A. Parsons & Co Ltd., Newcastle upon Tyne.

C.B.E.

Group Captain Douglas Robert Stewart Bader, D.S.O., D.F.C. For services to the disabled. Group Captain Bader is manager of Group Aircraft Operations Department, Shell Petroleum Co Ltd.

Group Capt Bader

Captain William Millar Hutchison, Chief Marine Superintendent, British Tanker Co Ltd. Capt Hutchison joined the British Tanker Company in 1919 as a second officer. He was appointed Master in 1928, assistant marine superintendent in 1935, and marine superintendent at the head office of the Company in 1943.

Capt W. M. Hutchison

O.B.E.

Douglas Gordon Duff, Lubricating Oil Adviser, Ministry of Fuel and Power.

F. N. Judson

M.B.E.

Francis Newlove Judson, Industrial General Sales Manager, Mobil Oil Co Ltd. Mr Judson has served his company with distinction in the United Kingdom and China for 41 years.

B.E.M.

Harold John Dixon, Foreman, Civil Reserve Oil Installation (Stourport), Regent Oil Co Ltd.

Henry Harrison, Boatswain, m.v. *Neaera*, Shell Tankers Ltd.

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Personal Notes

Colonel S. J. M. Auld, O.B.E., M.C., D.Sc., Ph.D., President of the Institute of Petroleum, has been appointed by the Minister of Fuel and Power to be a member of the Scientific Advisory Council which advises the Minister on the scientific aspect of his statutory duties.

G. F. Adams, B.Sc., A.Inst.P., scientific adviser, and **H. B. Toft,** B.Sc. (Physics), have been elected to the Board of Directors of A. Gallenkamp & Co Ltd.

H. E. Charlton, M.I.Chem.E., M.Inst.F., F.Inst.Pet., has resigned from the Board of Directors of Petrocarbon Developments Ltd in order to devote all his time and energy to his own company, H. E. Charlton Engineers Ltd.

T. R. C. Tompkins has been appointed to a new position, that of sales manager (Automotive), which has been created in the headquarters staff of the Mobil Oil Company. Mr Tompkins will be deputy to F. P. Barribal, general sales manager (Automotive). T. W. W. Thompson takes the place of Mr Tompkins as manager of the Retail Merchandizing Department and I. M. Forbes succeeds Mr Thompson as retail training supervisor at Caxton House.

G. H. Grigg, Stud.Inst.Pet., had the degree of Ph.D. conferred upon him at the degree ceremony at the University of Birmingham on 16 December. Dr Grigg is now doing his National Service in the Royal Navy.

Sir Henry Wilson Smith, K.C.B., K.B.E., has resigned from the Board of Mobil Oil Company Ltd on account of the increasing pressure of his duties in the Powell Duffryn Group and elsewhere.

G. R. Blakely, B.Sc.(Eng.), M.I.C.E., M.I.Mech.E., M.I.Prod.E., has been appointed to the Board of Directors of G. A. Harvey & Co (London) Ltd as Works Director.

W. D. Tattersall has been appointed purchasing manager of Kellogg International Corporation and **J. M. Sexton,** who previously held this post, has been appointed purchasing manager of Société Kellogg, a newly-formed subsidiary of The M. W. Kellogg Company.

Professor Frank Morton, M.Sc.Tech., Ph.D., D.Sc., F.R.I.C., M.I. Chem E., at present Professor of Chemical Engineering in the University of Birmingham, has been appointed to the newly-established Chair of Chemical Engineering in the Faculty of Technology at Manchester University. The establishment of this new chair is an important step in the provision of increased facilities for science students in the U.K.

Professor Morton is a prominent officer of the Institute of Petroleum and has held the position of vice-president since 1954. He was first elected to the Council in 1947 and first served as vice-president during the period 1950-53.

From 1936, when he took his degree at Manchester, until 1948, Professor Morton held appointments on research and development work in Trinidad, and, from 1945, in London as chief chemist to Trinidad Leaseholds Ltd. Since 1948 he has been at the University of Birmingham, first as Reader in Chemical Engineering, and since 1949, as professor.

W. H. R. Lloyds and P. J. McLinden have been appointed Castrol regional sales managers for the South Midland and Scottish Regions respectively. They succeed **T. M. Stephens** and **A. L. Grassie** who have retired after long service with the Company.

Dr A. J. Haworth, F. Inst. Pet, has been appointed to the Council of the American Association for the Advancement of Science to represent the American Association of Petroleum Geologists for the 1956-57 session.

J. R. V. Cooper has been appointed manager of the Fuel Oil Department at the Head Office of Fina Petroleum Products Ltd.

L. E. J. Brouwer, general managing director of the Iranian Oil Exploration & Producing Company and the Iranian Oil Refining Company in Teheran, will leave Teheran towards the end of March 1956 to assume a position of high responsibility in the Royal Dutch/Shell Group. He will be succeeded as general managing director of the two Operating Companies in Iran by the Dutch mining engineer, K. Scholtens, who at present holds a senior position in the Bataafsche Petroleum Maatschappij, the main Netherlands operating subsidiary of the Royal Dutch/Shell Group.

N. G. Buxton has been appointed assistant branch manager (Sales) at the Midland Branch of the Regent Oil Company Limited. Mr Buxton's former position was manager of the London South Division.

J. W. Hyde has relinquished his appointment as marketing assistant, Dealer Development Section, to take over the appointment of divisional manager, London South Division of the Regent Oil Company Ltd.

T. R. Hardman has been appointed general manager of Tecalemit Ltd, manufacturers of lubrication equipment. Mr Hardman has been with the Company since 1941. In 1950 he became personal assistant to the managing director and in 1954 was made a director of the newly acquired company of Foamite Ltd.

G. A. Dickins, B.Sc. (Hons), A.R.I.C., F.Inst.Pet., has succeeded R. B. Killingsworth, Ph.D., F.Inst. Pet., as manager of Mobil Oil Company's Technical Department.

Dr Killingsworth has returned to the United States. He had been in the United Kingdom since 1952, when he was seconded by Socony Mobil Oil Co Inc (then Socony-Vacuum) to the Mobil Oil Co Ltd (then Vacuum Oil Co Ltd) to deal with problems arising from the commissioning of Coryton Refinery in 1953.

Mr Dickins has been with the Mobil Oil Company since 1951. He has been assistant manager of the Technical Department since June 1955.

Mobil Oil Company Reorganization

Rapid expansion in the retail marketing of Mobilgas in the Midlands has led the Mobil Oil Company to divide its Midland Automotive Division into two new divisions. One is to be known as the North Midland and the other as the South Midland Automotive Division.

The managerial staff of the former Midland Automotive Division are controlling the North Division. S. F. G. Mann is divisional manager, T. N. Jackson and E. Wood, district managers, and H. A. Mason, office manager.

Divisional manager in the new South Midland Division is V. C. Beaumont; G. N. P. Edwards and H. A. Rich are district managers, and H. G. Eldershaw is office manager.

OBITUARIES

It is with regret that we record the death on 23 December 1955 of Mr James Todd of Newcastle. Mr Todd, who was a well-known figure in the lubricating oil trade, had been President of the British Lubricating Oil and Grease Federation since 1953, and had been an active member of the Council of BLOGRO since its formation 10 years ago.

Baird & Tatlock (London) Ltd regret to announce the sudden death on 2 January of S. J. Matthews, head of their Research and Development Division.

Sir Bernard Keen, D.Sc., F.Inst.P., F.R.S., is temporarily taking charge of the Research and Development Division.

Books and Films

Control of Oil Fires by Air Agitation

"Beneath the Flames", a dramatic 20-minute colour film, is one of the vehicles used by Socony Mobil Oil Co Inc to make known the results of their study of the air agitation method of oil fire extinguishment and control.

Both laboratory experiments and large-scale oil fire tests are used in the film to illustrate the method which has been developed. This involves the utilization of air or other gas injection to induce upward flow from the colder sub-surface body of the oil layer and thereby to cool the surface of the burning liquid. The cooling is sufficient to extinguish fires of high flash-point oils and to reduce the severity of fires of low flash-point oils so that they can be readily extinguished by conventional means.

Detailed information about the agitation method is available from Socony Mobil Oil Co Inc and the film "Beneath the Flames" is available from the Company's Film Library, 26 Broadway, New York 4, N.Y.

"Cutting and Metalworking Oils"

The latest addition to the C. C. Wakefield range of technical books is an entirely new treatment of the first subject dealt with in that series—cutting oils.

The new version, "Cutting and Metalworking Oils" is a well-illustrated 80-page book which covers its subject comprehensively. After a brief history of metalworking and cutting and a survey of the basic processes involved, the book goes on to the functions of cutting fluids. One chapter deals with the machining of special materials and others cover cold-working lubricants and heat treatment oils.

Copies of the book can be obtained free of charge from C. C. Wakefield & Co Ltd, 46 Grosvenor Street, London, W.1.

Motor Cyclists' Handbook

Now in its seventh edition, "High Efficiency", published by Mobil Oil Co Ltd as a handbook for motor cyclists, contains a considerable amount of information which should enable the user of a motor cycle to obtain better service from his machine. Information is given regarding lubrication systems and the method of applying lubricants to the machine, together with details of the motor cycle engine and its method of operation. The cause and remedy of various troubles are also set out and in addition there are interesting articles on touring, on advance tuning, on trials and scrambles, and on safety, each written by an expert on the subject.

Copies of the 84-page booklet are obtainable from Mobilgas and Mobiloil dealers or from the Company's Advertising Department, Caxton House, Westminster, London, S.W.1.

Refrigerator Lubrication

A new technical booklet entitled "Refrigerator Lubrication" has been published by the Mobil Oil Company Ltd in its series of technical publications. It is a 72-page booklet and is copiously illustrated.

After an opening discussion of the principles of refrigeration the booklet deals with the construction and operation of refrigerating circuit units, the lubrication of compressors in refrigeration systems, and the compatibility of various refrigerants with lubricating oils. The booklet also contains a set of operating notes and recommendations regarding the choice of lubricants for refrigeration compressors.

Copies of this booklet can be obtained from Mobil Oil Company Ltd, Caxton House, London, S.W.1. or from the Company's Industrial Divisional Offices.

Safe Use of Industrial Trucks

A safety code designed to appeal to drivers of industrial power trucks has been published by the Industrial Truck Manufacturers' Association.

Amusingly illustrated, the code is an extract from a larger publication dealing with design and other factors connected with the safety of industrial transportation equipment. The extracted portion illustrates a number of important safety rules and spotlights the hazards which are likely to occur when using industrial trucks.

Copies of the booklet can be obtained from the Secretaries, Industrial Truck Manufacturers' Association, 94-8 Petty France, London, S.W.1. Price 1*s.* each post free or 10*d.* each for quantities of twelve and over.

1956 Production Exhibition

The Second Production Exhibition will be held at Olympia from 23 to 31 May this year. It is being sponsored by the Institution of Production Engineers and will be held in conjunction with the Institution's 1956 Conference.

The Exhibition will deal with the science of productivity in all its aspects. In addition to demonstrating techniques for increasing productivity it will deal with the quality of the processes by which production is achieved and the research effort required to uphold production.

Details concerning the Conference can be obtained from The Conference Secretary, The Institution of Production Engineers, 10 Chesterfield Street, London, W.C.1.

1956 Factory Equipment Exhibition

A display illustrating the use of oil fuel in industry is to be a special feature of the Factory Equipment Exhibition which will be held at Earls Court from 9 to 14 April 1956.

This is the fourth exhibition of its kind and it will be opened by the Rt. Hon. Peter Thorneycroft, M.P., President of the Board of Trade.

Productivity will be the keynote and the British Productivity Council is to hold a three-day conference during the Exhibition.

Apart from exhibits showing the use of oil for factory space-heating, steam-raising, and other heating processes, there will be a wide range of other equipment and methods on show. These will cover factory construction, equipment, and maintenance; handling, storage, and packaging; engineering products, welfare and safety equipment, and drawing office and works office machines and systems.

A limited number of complimentary tickets for the Exhibition are available to members of the Institute on application to the General Secretary.

The Gasification of Fuel Oil*

By F. H. GARNER, O.B.E.† (*Fellow*) and R. LONG†

PART II—CATALYTIC GASIFICATION

Catalytic Gasification

The chemical reactions which occur during the cracking of fuel oil are complex, particularly the stages which result in carbon deposition. One train of reasoning in attempting to avoid carbon formation seems to have been more or less as follows: hot carbon reacts with steam, this reaction is known to be catalysed by alkali and alkaline earth bases[10], and a possible method of controlling carbon formation might be found by using such catalysts to accelerate the reaction between carbon and steam during oil gasification. This seems to have been tried first in the laboratory experiments of M. A. Elliott and W. J. Huff[11] in 1934. These workers used magnesia refractory brick impregnated with 5 per cent of sodium carbonate. They found a pronounced increase in the gasification of the oil carbon and a corresponding decrease in the carbonaceous deposits. There was also an increased thermal yield of gas (of lower calorific value). The marked volatility of the alkali of the catalyst was noted. This early work did not seem to lead to any new developments in commercial processes.

H. Stanier and J. B. McKean in the earlier of their recent papers[12] reported the development and use of a lime-bauxite catalyst and, more recently, a very refractory lime-magnesite catalyst which will withstand temperatures of up to 1600 C without fusion or loss of activity has been developed. In their earlier paper these workers suggest that the catalyst may in fact do rather more than promote the steam-carbon reaction and that it may promote the direct reaction between hydrocarbons and steam. Lime also reacts with sulphur compounds released from the oil during gasification and these are converted to SO_2 during the oxidation stage. The lime-magnesite catalyst is employed in the "Segas" process.

Nickel is known to be an active dehydrogenating catalyst and is also active in the reaction between methane and steam which is employed for the manufacture of industrial hydrogen or synthesis gas from natural gas. It might be expected that in using a nickel catalyst there would be an acceleration of the reaction between hydrocarbons and steam.

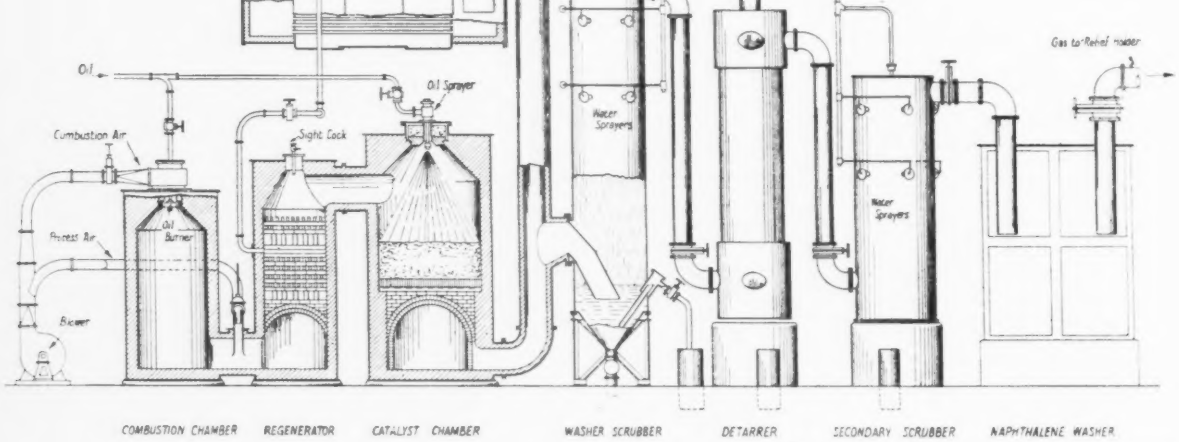
A number of years ago the American Gas Association[13], interested in the possible development of a process for making peak-load gas by the catalytic gasification of higher hydrocarbons in steam, studied nickel-alumina catalysts. It was found, however, that carbon deposition could not be avoided with hydrocarbons higher than propane or butane. A nickel type catalyst is, however, used in the ONIA—GEGI process of oil gasification.

The Segas Process

This process originated in the laboratories of the former South Metropolitan Gas Company[12] and after nationalization it was developed by the South Eastern Gas Board. The sole licensee of the commercial process is the Power Gas Corpora-

*Paper read to the Institute of Petroleum, Stanlow Branch, 19 October 1955.

†Department of Chemical Engineering, University of Birmingham.



By courtesy of the Institution of Gas Engineers

Fig. 3. ONIA—GEGI oil gas process (Stafford plant).

tion Ltd, and a number of plants have been erected. The first commercial plant to be operated was one of approximately 800,000 cu.ft. per day at Sydenham and this was followed by a plant at York. The Sydenham plant and the operating results have been fully described by Stanier and McKean[15], together with suggestions for the improvement in design of future plants.

The process is designed to produce gas with calorific value, specific gravity, and other combustion characteristics similar to those of coal-gas. The latest design of plant is illustrated in Figure 4. The gasification unit consists of two vessels only, one containing the catalyst bed and below it chequer brickwork for preheating the air, and the other the steam preheater and an empty chamber for vaporizing the oil. These two vessels are of mild steel, brick-lined construction and are joined at the top.

The process is cyclic; during the make period, steam enters at the base of the steam preheater and passes upwards into the vaporizing chamber where it meets oil sprayed in at the top. A refractory throat imparts sufficient velocity to the steam to prevent oil droplets from the spray falling into the chequer-work below. The steam-oil mixture passes over to the catalyst bed, above which may be placed another spray for the addition of oil. Gas formed on passage through the catalyst bed passes downwards through the air preheater, giving up much of its sensible heat before going forward to the wash-box and washer-cooler.

At the end of the make period, a steam purge clears the plant of gas and an air blast then passes in the reverse direction. The air is heated in the air preheater and burns away carbon deposited in the chequer-work and catalyst bed, vaporizing chamber, etc. The carbon therefore provides heat for the process, although an oil burner is provided to supplement and control the heat requirements of the unit. The waste gases, after giving up some heat in the steam preheater pass to a waste heat boiler. (No waste heat boiler was provided in the earlier Sydenham plant.)

The blow period is followed by a short purge and the next cycle then begins.

The Segas plant is now available in five standard sizes ranging from 250,000–3,200,000 cu.ft. per day. The plant is easily started up or shut down so that it is useful for meeting peak-loads.

Results of tests on the Sydenham plant are given in Table V. The results may be summarized as follows.

(*i*) The plant can be operated on heavy fuel oil of 950 sec viscosity (Redwood No. 1 at 100°F) with a Conradson carbon figure of 10 per cent.

(*ii*) The gas calorific value can range from 450–550 B.t.u/cu.ft.

(*iii*) The gas yield is approximately 1·2 therms/gallon of oil and the thermal efficiency of gas production (therms in gas/therms in total oil) is about 67 per cent. However, it must be remembered that the steam used in the Sydenham plant is not provided by the process itself.

(*iv*) The gas is of low H_2S content in spite of the fact that the oil contains over 3 per cent of sulphur. The organic sulphur content is moderate.

(*v*) An unfavourable feature of the gas is its high content of CO_2 (10–12 per cent) and its consequent relatively high specific gravity of 0·55–0·58.

(*vi*) The cost of gas for a 4 million cu.ft. per day plant has been estimated to be, for London 10·4*d*. per therm and for other areas about 10·8*d*. per therm. (The price of fuel oil has increased slightly since these figures were estimated.)

TABLE V

RESULTS OF TESTS (MODIFIED FROM STANIER AND McKEAN[15])

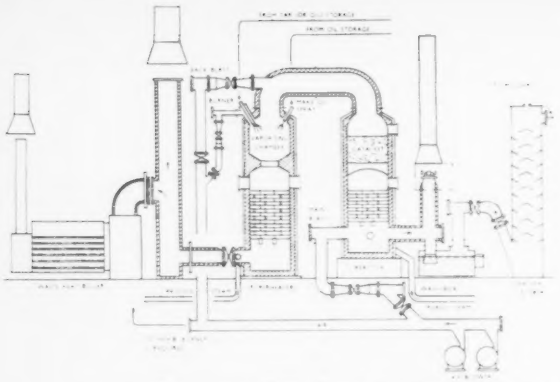
Type of oil	Heavy fuel oil (950 sec)	Heavy fuel oil (950 sec)
Total oil used during test (gal)	55,415	51,908
Steam used (lb)		
(*a*) with oil during "run"		
per gal oil	13·70	12·60
per lb oil	1·42	1·31
(*b*) Total per gal oil	22·22	21·16
Air used, cu.ft. per gal	978	987
Catalyst bed temp, C		
bottom	505	750
middle	1045	880
top	705	700
Gas made and used		
made per gal oil (therms)	1·23	1·25
used per gal oil (therms)	0·06	0·07
net yield per gal oil	1·17	1·18
Average calorific value B.t.u/cu.ft.	502	473
Average specific gravity	0·55	0·58
Gas analysis		
CO_2	11·0	12·1
O_2	0·4	0·6
C_nH_m	6·7	5·2
CO	14·7	16·7
H_2	48·9	48·2
$CH_4+C_2H_6$	15·3	13·5
N_2	3·0	3·7
H_2S grains/100 cu.ft.	50–250	
Organic sulphur cu.ft.	30– 40	
Thermal efficiency of gas production	66·8	68·2%

It is also interesting to compare the results of the Sydenham and York "Segas" plants:

	Sydenham	*York*
Gross cal. val. oil (B.t.u/lb)	18,260	18,090
Gross therms/gal oil	1·25	1·21
Net therms/gal oil	1·18	1·16
Steam: oil ratio	1.31	1·09
lb steam/gal oil	21·16	22·44
tar gal/100 gal oil	10·4	12·7

The ONIA–GEGI Process

This process is a development of one devised for the production of ammonia synthesis gas from heavy oil. L'Office National Industriel de L'Azote (ONIA) in collaboration with the French associated company of Humphreys and Glasgow (GEGI) operated a pilot plant for the manufacture of town gas from heavy fuel oil at Cahors[14]. A larger plant of over 1 million cu.ft/day capacity has been built at Stafford by Humphreys and Glasgow for the West Midlands Gas Board.



By courtesy of The Power-Gas Corporation Ltd.

Fig. 4. *Segas catalytic oil gas process.*

This has been described by G. le B. Diamond[3]. The plant, illustrated diagrammatically in Figure 3, comprises a combustion chamber having a steel shell and lined with refractory bricks, at the top of which an oil burner is placed which can spray oil downwards. Air for combustion is also admitted at the top and is directed tangentially downwards. A preheater partly filled with chequer-work is situated between the combustion chamber and the catalyst vessel. The plant is provided with a waste heat boiler.

The operating cycle lasts for $8\frac{3}{4}$ minutes and comprises a blow period and a run or make period occupying 47 and 50 per cent of the cycle respectively, with a 3 per cent steam purge between. During the blow period, oil is burned with primary air introduced into the top of the combustion chamber, and additional air necessary to burn carbon from the catalyst is mixed with the products of combustion at the inlet to the preheater. The mixture of air and combustion products then flows downwards through the catalyst bed and away to the waste heat boiler. During the make period, steam is introduced into the preheater and oil is sprayed on the top surface of the catalyst, the resulting gas passing away to the washer-scrubber. The oil is usually shut-off some time before the steam to allow complete removal of oil vapour.

The Stafford plant is designed to produce about 1 million cu.ft. per day of 450 B.t.u/cu.ft. gas, and is self supporting in steam.

Summary of Results

Preliminary operating results have been given in the paper by G. le B. Diamond[3], while M. J. F. Olden[16] has given more recent results together with details of early operating difficulties.

(*i*) The plant can be operated on heavy fuel oil of 950 sec viscosity (Redwood No. 1 at 100° F) with a Conradson carbon figure of 10 per cent.

(*ii*) The gas calorific value can range from 450 to 550 B.t.u/cu.ft.

(*iii*) Yield of gas for August 1955. The average gas yield of the Stafford plant is approximately 1·07 therms/gallon of total oil, corresponding with a thermal efficiency of gas production (therms in gas/therms in total oil) of 60 per cent. However, higher figures than this have been recorded[24] and the figures in Table VI are typical ones[25]. As already mentioned, the Stafford plant is self-sufficient in steam while the Sydenham Segas plant is not.

(*iv*) The organic sulphur content of the gas is moderate (26-32 grains/100 cu.ft. are typical figures).

(*v*) The CO_2 in the gas is rather high (10-12 per cent) giving a relatively high specific gravity of 0·57-0·62.

(*vi*) The cost of gas has been estimated to be approximately 10·7*d.* per therm, but the price of fuel oil has since risen slightly.

(*vii*) The tar is obtained in a highly emulsified state making it difficult to handle.

A number of oil gasification plants of the ONIA—GEGI type are now being installed in the United Kingdom. The majority of these are of the regenerative type based upon a plant in operation at Solihull which has been described by G. le B. Diamond[3]. This plant gives a high yield of gas and typical results are included in Table VI. Unlike the Stafford plant, the regenerative type is not self-sufficient in steam. Figure 5 illustrates the difference between the regenerative system and the so-called self-steaming system in which a waste-heat boiler provides for all process requirements. A thermal efficiency of gas production of about 70 per cent has been attained with the regenerative type of plant but, of course, the plant must be supplied with the necessary steam. This is no disadvantage where steam is available cheaply from boilers already in use.

Both types of plant have now been modified so that the oil is sprayed into the steam regenerator rather than on to the catalyst. The oil is carried forward to the catalyst chamber intimately mixed with steam.

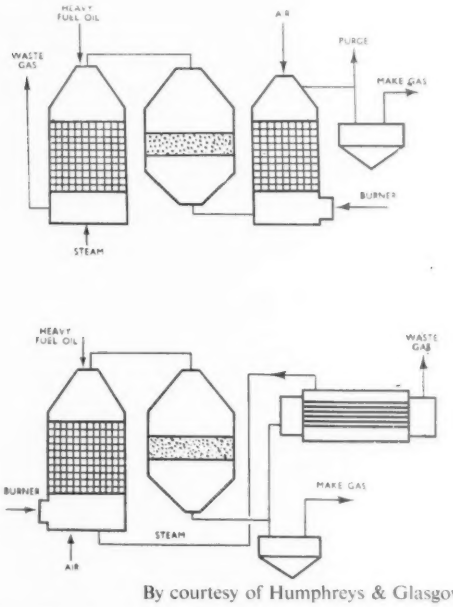
It can be seen that the catalytic processes offer considerable promise of being able to deal effectively with heavy fuel oil of

TABLE VI

ONIA—GEGI CATALYTIC OIL GASIFICATION PLANT RESULTS[25]

Type of plant	Regenerative		Self-steaming	
Location	Solihull		Stafford	
Hydrocarbon feed	Heavy fuel oil (950 sec)			
Cal.val. of gas, B.t.u/cu.ft.	500	450	500	450
Therms gas/gallon *make* oil	1·29	1·37	1·29	1·37
Therms gas/gallon *total* oil	1·25	1·30	1·07	1·13
Thermal efficiency of gas production	70%	73%	60%	64%
Steam raised: therms per gallon total oil	None	None	0·17	0·16
Steam for gas-making, lb/1000 cu.ft. make gas	40	37	39	35
Dry tar, per cent by volume of total oil	9·0	7·0	7·0	6·0

950 sec viscosity and may well be able to deal also with Bunker C fuel oil or with crude petroleum. Gas can be produced at a cost which compares favourably with that of base-load coal-gas. However, the consensus now seems to be that although there is much scope for the gasification of fairly large amounts of heavy oil by the gas industry there is also an increasing general demand for such fuel, for electricity generating stations, etc. The future development of heavy oil gasification will depend largely on the availability of such fuels in the future. These newer processes may lend themselves, however, to the utilization of those fuels which happen to be in least demand at any particular time and the importance of linking them up with refinery operations can be seen. The South Eastern Gas Board has, in fact, already arranged in



By courtesy of Humphreys & Glasgow Ltd

Fig. 5. ONIA—GEGI oil gas process showing (above) *regenerative and* (below) *self-steaming types.*

co-operation with the British Petroleum Company to erect a large catalytic gas-making plant at the Company's refinery at the Isle of Grain. This plant will probably gasify any feed-stock available, the gas being taken into the distribution system of the South Eastern Gas Board.

Evaluation of Oils for Gas-Making

Probably the only way of determining exactly how an oil is going to behave during oil gasification is to try it in the actual process to be operated. However, laboratory tests may be useful in giving an indication of the results to be expected when an oil is used on the plant.

As already mentioned, R. H. Griffith has shown that a useful indication of the thermal yield of permanent gas can be obtained for a gas oil if the proportion of chain compounds (paraffins and olefins), is determined. Since heavy fuel oils are much more complex mixtures than gas oil, this method is not applicable. In the U.S.A. various laboratory cracking tests have been developed for both gas oils and heavy oils[17,18]. The results of such tests usually show:

(*i*) The therms recovered in the gas per gallon of oil,
(*ii*) the number of cubic feet of gas produced per gallon of oil, and
(*iii*) the calorific value of the gas.

The tests are often made at two or more temperatures in order to obtain an idea of the optimum cracking temperature. The most recent work in this field is probably that of H. R. Linden and E. S. Pettyjohn[19] who characterized the oils which they examined by their C:H weight ratios and by their Conradson carbon residues. Thermal recovery in the gas made, total yield of oil gas, carbon deposition, etc. were correlated with operating variables and with properties of the oil and the correlations were found to agree well with actual plant results. Paraffin hydrocarbons are most useful for gas making because they have the highest carbon:hydrogen ratio and the problem is very largely one of converting the fuel oils with a carbon:hydrogen weight ratio of 7 to 8:1, that is of a formula approximating to C:H = 1:1·6, into methane (C:H = 1:4) and ethylene (C:H = 1:2), the two most useful hydrocarbon components in gas. The excess carbon can, of course, be used for supplying the heat required in the process or for conversion to carbon monoxide. Carbon:hydrogen ratio is thus the most important property for gas making and whilst this can be determined directly it is usually determined from correlations with physical properties such as specific gravity, viscosity, or aniline point. From the results of laboratory cracking experiments at a temperature of 700 – 800°C a relationship between the gas enrichment value (for both distillates and residual fuels) and the carbon:hydrogen ratio has been deduced[3]. This may be expressed in the form: Gas enrichment value; thousand B.t.u. per lb = 30·05—2·462 CH. As an empirical indication of carbon:hydrogen ratio the diesel index may well serve as a useful factor and the viscosity-gravity constant has been suggested by A. B. Densham[20] for the evaluation of oils for gas-making by the newer catalytic process. However, it would appear that the "characterization factor" $K = 3\sqrt{T_m}/\text{specific gravity}$ (where T_m = the mean boiling point in °Rankine), which is so widely used in the petroleum industry would be a more suitable indication of C:H ratio. Since the production of gas from fuel oil is essentially a matter of cracking, only the oil which can be vaporized will be of use to produce hydrocarbon components in the gas, and thus the Conradson or Ramsbottom carbon is an important factor in the evaluation of fuel oils for gas making. Carbon is left behind on the chequer-work or on the catalyst and can be utilized to provide the heat necessary in the process, being converted to either CO_2 or CO.

One other point of importance in the evaluation of fuel oil for gas making is the sulphur content, since obviously the higher the sulphur content the more purification is necessary. There are indications that fuel oil gives a moderate organic sulphur content in the gas and this sulphur is probably present in the form of carbon oxysulphide and carbon disulphide. A great advantage of hydrogenation processes for the production of gas for both industrial and domestic purposes is that the sulphur is transformed into hydrogen sulphide which can be completely removed giving an exceptionally pure industrial gas. The trend in gas making in the future will, undoubtedly, be towards reducing the sulphur content (apart from hydrogen sulphide) as low as possible since it is recognized that butane and other pure hydrocarbon gases have an advantage over coal-gas from the point of view of corrosion of pipelines and particularly corrosion in gas-heating appliances, such as water heaters.

Acknowledgments

The authors wish to express their thanks to the following, from whom they have received valuable help in the preparation of this paper: G. le B. Diamond, C.B.E., chairman of the West Midlands Gas Board; H. T. Cohen and W. Hartley of Humphreys and Glasgow Ltd; R. O. Richards of the Woodall-Duckham Construction Company Ltd.

Discussion

S. Ashworth: The gas industry in the U.K. has for many years depended upon the use of carbonization coals and gas oil as its two primary raw materials, the consumption of gas oil being some 6 to 7 per cent in "gas making" capacity of the coal carbonized. Until quite recently this gas oil has been used almost exclusively in the traditional carburetted water gas (CWG) plant and this fact, together with our dependence upon coal, has in effect somewhat tended towards our falling behind American and Continental practices in the use of catalytic and other plants such as those reviewed in this paper.

The authors cite the decreasing supply of gas-making coals and the increasing cost of these, as reasons for the gas industry looking towards processes for the production of gas from sources other than the usual gas-making coals. Whilst I agree with this, I feel that the development of oil gasification processes in the U.K. was brought about by the increasing understanding of the problem of peak load gas supply and the concern at the high cost of gas made to meet peak demands. This was certainly the case in the work carried out by Stanier and McKean which led ultimately to the development of the Segas process. Whilst the operating and raw materials costs cannot be ignored, it is of the utmost importance in such processes that capital and other fixed charges on the plant should be at a minimum, as these charges add so much to the cost of gas manufactured at low load factors.

More recently, and in particular during the past three years, the restriction on the supplies of coal made available to the gas industry has forced the industry to use much greater quantities of oil. Indeed, for the past two years we have often been placed in the Gilbertian position of having to base load our peak load oil consuming plant and meet load fluctuations with our base load carbonizing plant. Such a state of affairs naturally made the industry examine raw material costs for the peak load plant and did much to develop interest in the use of heavy oils for gasification.

There are, of course, disadvantages in the use of these residual oils which tend somewhat to offset their lower cost. As the authors point, out, heated pipelines and storage tanks are required and in carburetted water gas manufacture considerable accumulations of carbon have to be dealt with. In both CWG and catalytic plants the tendency for the formation of tar emulsions is a serious problem. The use of hot gas detarring and the introduction of surface active agents (such as amine 220) into circulating systems has done much to ease this problem, but the measure of success has to some extent depended upon local circumstances.

It is important that oil gasification processes produce gases having combustion characteristics not very dissimilar to those of normal town gas. With this in mind, it is interesting to note that the South Western Gas Board are installing a two-shell version of the Hall process, a plant which produces gas of high calorific value and high specific gravity. It is proposed to mix the gas with by-product gas of low calorific value and low specific gravity from the Jones plant, and presumably the resultant mixture will have acceptable combustion characteristics. It might be felt, however, that this unusual combination of processes is not likely to be met again in our industry and as a result the development of the Hall process in the U.K. may be limited.

The Hall plant is, however, a most capable plant when dealing with heavy residual oils with high Conradson carbon contents and, no doubt with this in mind, Gaz de France are installing at their new Alfortville Works in Paris, separate blue water gas plants with Hall oil gas plants to provide the enrichment gas from heavy oils. In effect they are installing two specialist plants rather than endeavouring, as we so often do, to combine both processes in the one CWG plant.

The Hall process claims several advantages over other oil gasification processes:

(*i*) The plant, without structural alteration, can use any type of feedstock from heavy fuel oils to gasoline;
(*ii*) it is available up to a size of 7 million cu.ft/day;
(*iii*) its capital cost is lower than the catalytic types;
(*iv*) its overall thermal efficiency is of the order of 80 per cent.

Here I should perhaps emphasize that the figures of 50 to 60 per cent given in Table III in the paper refer to the thermal efficiency of gas production.

Should it be found possible to use the plant in conjunction with, say, a Koppers Hasche reformer to produce a lower calorific value gas with more acceptable combustion characteristics, then the combination might prove a serious competitor to the catalytic plants which are at present arousing so much interest.

The authors have shown in their paper the possibilities that lie before us in the use of oil for gasification purposes. I feel that it might perhaps be appropriate if I said a few words on possible future development.

In 1953, the gas industry, together with the coking industry, carbonized between them 52·9 million tons of coal. Of the national output of 211·8 million tons of coal, carbonization coals totalled 98 million tons. Hitherto we have had to take our share in competition with other users of these coals, the domestic consumer, the railways etc. The advent of the Beaver Report and its adoption by the Government can only result in the gas industry having to play a great part in the production of solid smokeless fuels. In fact its success demands that we carbonize increasing quantities of additional coal now being burnt in domestic grates and by industry. We are already being exhorted to produce as much coke as possible and to this end we are now receiving unlimited supplies of coal. The result in my own particular Group of Undertakings has been that whereas during the five summer months of last year we carburetted about half-a-million gallons of oil, during the same period of this year we used only some 86,000 gallons. I mention these figures to show that circumstances can alter and sometimes to a very marked degree.

Despite this, I feel that the petroleum and gas industries must co-operate more and more closely, and indeed in the very near future, in meeting the country's fuel requirements. The petroleum industry, I understand, has a problem which probably only those engaged in it can measure. I am referring to the problem of balancing production of the various products against demand. The authors have indicated some of the ways in which oil products may be gasified. Indeed the arrangement made between the South Eastern Gas Board and the British Petroleum Co Ltd, whereby the Board and the Company jointly are building a plant based on the Segas catalytic oil gasification process capable of producing up to

45 million cu.ft. of town gas daily from a wide range of petroleum products from butane to heavy oil fuel, is an indication of the part that can be played by the two industries.

Given sufficient suitable coal, the gas industry could expand its sale and production of gas and coke to help solve the country's smokeless fuel problem. If, at the same time, it is to play a part in utilizing petroleum products ranging from refinery gas to heavy residual oils in the manufacture and distribution of gas, then new markets must be found for much of these additional supplies. It would be wrong, in my opinion, to take these supplies at a price which just makes it economic to shut down existing gas-making units but does little to develop additional gas sales. The cost of gas produced from petroleum products in the new processes, working under base load conditions, must be sufficiently attractive to enable new fields of consumption to be rapidly developed and I suggest to the petroleum industry that if it desires to take full advantage of the potential outlet for its surplus products through the gas industry, then the price charged for these products must be determined realistically.

F. H. Garner and R. Long: As regards the several advantages claimed for the Hall Process over other oil gasification processes, the catalytic processes can also use a wide range of feedstocks and although the maximum size of a single unit at present available is about $3\frac{1}{4}$ million cu.ft/day, a number of such units can be used if a greater gas output is required.

In following the Report of the Beaver Committee and attempting to increase the available supply of coke, it is important to bear in mind that gas is a superior smokeless fuel to coke and it is, moreover, virtually sulphur-free.

The long-term future policy of the gas industry should be to aim at producing gas as cheaply as possible, on the largest possible scale, as the factor which deters the domestic and industrial consumer from using gas, electricity, or oil in preference to solid fuel (whether smokeless or otherwise), is relative price. The aim of the gas industry should therefore be to reduce the price differential between gas and solid fuel. Unless appreciable amounts of natural gas are discovered in the United Kingdom, the best policy would, therefore, appear to be to concentrate upon the complete gasification of coal as near the pit-head as possible. This gas could be enriched and supplemented by gas produced from oil.

With regard to Mr Ashworth's last comment, fuel oil is used as marine and industrial fuel and the consumption for these purposes is much larger than that by the gas industry. A relevant factor is that the energy requirements in the U.K. are increasing at such a rate that domestic coal production and the utmost possible expansion in the atomic energy field together have difficulty in meeting the demand for power; therefore, either coal or petroleum must be imported and the view of the Government appears to be that the import of petroleum rather than coal places less stress on the country's resources from the point of view of dollar demand. The price of fuel oil is dependent on the price of crude oil and of all the other products obtained from crude petroleum. Fuel oil cannot be considered a surplus product and there are methods of delayed coking and fluid coking available to convert fuel oil into middle distillates and other products, depending on the market demand; it is this factor which dominates petroleum refining, as it does, for example, the gas industry in regard to gas and coke (although in both cases yields and ease of utilization of the product are of great importance).

References

1. Griffith, R. H. "Science of Petroleum", Vol. IV, p. 2523. Oxford University Press, 1938.
   J. Soc. chem. Ind. Lond., 1928, **48**, 252T.
2. Dashiell, P. T., *Proc. Amer. Gas Ass.*, 1930, 886-897. Proceedings of Joint Conference on Modern Applications of Liquid Fuels. Institute of Fuel and Institute of Petroleum, 1948.
3. Diamond, G. le B. Institution of Gas Engineers Communication, No. 456, 1954.
4. Willien, L. J. "Science of Petroleum", Vol IV, p. 2501. Oxford University Press, 1938.
5. Morgan, J. J. "Gasification of Hydrocarbons". New York, Moore Publishing Co Inc, 1953.
6. Taylor, C. L. *Gas World*, 1951, **133**, 130.
7. Gill, G. M., and Jones, L. B. *J. Inst. Fuel*, 1938, **11**, 423.
8. Boyer E. G., (also Morgan, J. J.) American Gas Association Research Bulletin Project H. B.—1.
9. Utermohle, C. E. *Amer. Gas Ass. Mon.*, 1949, **31** (2), 21. Chambers, R. J. *Ibid.*, 1947, **29**, 323.
10. Marson, C. B., and Cobb, J. W. *Gas J.*, 1926, **175**, 882-891.
11. Elliott, M. A., and Huff, W. J. *Industr. Engng Chem.*, 1934, **26**, 480.
12. Stanier, H., and McKean, J. B. Institution of Gas Engineers, Communication No. 375, 1950
13. Riesz, C. H., *et al. Amer. Gas Ass. Mon.*, 1946, **28**, 159.
14. Delsol, M. R., Billion, M. R., and Pilloy, M. M. *J. des Usines à Gaz.*, 1953, **77** (6), 182.
15. Stanier, H., and McKean, J. B. Institution of Gas Engineers, Communication No. 457, 1954.
16. Olden, M. J. F. Contribution to discussion on paper presented to Midland Section, Institution of Gas Engineers by G. le B. Diamond.
17. Downing, R. C., and Pohlmann, E. F. *Proc. Amer. Gas Ass.*, 1916. Part I, p. 588.
18. Dick, I. G. *Amer. Gas (Engng) J.*, 1933, **138** (6), 32.
19. Linden, H. R., and Pettyjohn, E. S. American Gas Association, Pamphlet P. C. 51-9, 1951.
    Amer. Gas Ass. Mon., 1951 **33** (6) 14-15.
    Inst. Gas Techn. Res. Bull. 12, 1952.
20. Densham, A. B. Contribution to discussion on paper by G. le B. Diamond. Institution of Gas Engineers, Communication No. 456, 1954.
21. Dent, F. J. "King's Manual of Gas Manufacture" (revised) Section 3. London: King, 1951.
22. Maccormac, M. Gas Research Board Communication G. R. B. 38, 1948.
23. Cheetham, H. S. Proceedings of Joint Conference on Modern Applications of Liquid Fuels, 1948.
24. Diamond, G. le B. Private communication.
25. Cohen, H. T. Private communication.

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CRUDE OIL PRODUCTION

	1955	
	Nov.	*Jan.-Nov.*
Kern Oil Co Ltd:	*Brl*	
California	106,347	
Trinidad	82,908	
Trinidad Petroleum Development Co Ltd	334,508	
	Tons	
Kuwait Oil Co Ltd	4,425,063	49,587,520
Iraq Petroleum Co Ltd	1,969,207	22,006,181
Basrah Petroleum Co Ltd	583,060	6,552,452
Mosul Petroleum Co Ltd	106,888	1,179,335
Qatar Petroleum Co Ltd	467,655	4,905,461

Notes of the Month

"Border Terrier"

On 29 December the last of a series of ten 16,000-dwt tankers built for the Lowland Tanker Company was launched from the Sunderland yards of J. L. Thompson Ltd.

The British Petroleum Company has a 50 per cent interest in the Lowland Tanker Company and the vessel was named *Border Terrier* by Mrs B. R. Jackson, wife of BP's new chairman.

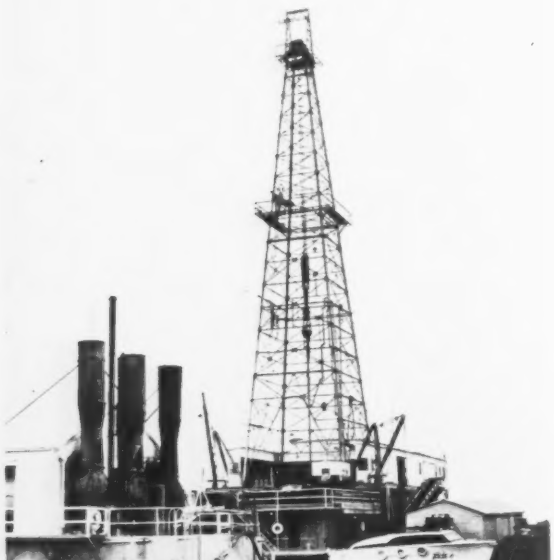
New Deep Drilling Record

The world's record for deep well drilling, established in California in 1953, has been broken by the drillers of a marshland well in Plaquemine Parish, Louisiana. The former record was 21,482 feet and the new well has passed that depth and may be drilled to 22,500 feet or deeper.

Drilling is being carried out jointly by Richardson and Bass for themselves and their partners J. W. Mecom and the Freeport Sulphur Company.

Drilling first began on 26 February 1955, with a hiatus of 2½ months while sands were tested between 16,000 and 19,000 feet. The approximate cost so far has been $1,350,000.

A barge-mounted rig with a National Supply Company steam-powered draw works has been used for the task, the barge being 140 feet in length, 54 feet wide, and 12 feet deep. The derrick rose 136 feet. Enormous strings of drill pipe and casing were, of course, needed for this operation and 6266 feet of 7-inch, 32-pound N-80 Spang Extreme Line Casing was used as a liner from 13,486 feet to 19,572 feet.



The barge-mounted rig which has set up a new record for deep drilling, pictured at its location in the Mississippi Delta marshes.
On the left is part of a separate barge carrying the steam boilers for the drilling operation.

Wakefield-Dick Industrial Oils Ltd

W. B. Dick & Co Ltd, principal subsidiary of C. C. Wakefield & Co Ltd, has been reconstituted as Wakefield-Dick Industrial Oils Ltd. This new company will take over the work of the former Wakefield-Dick Industrial Lubricants Division of C. C. Wakefield & Co Ltd and will operate solely in the U.K. All the export business of the Group will be carried out by the Overseas Division of the present company.

On the Board of Directors of the Company are two members of the Institute, L. M. Broadway, deputy chairman and managing director, and G. H. Thornley.

Improvements in Dakar Harbour Facilities

Recent developments at Dakar in French West Africa have greatly improved the port's hopes of capturing the major part of the bunkering trade in the South Atlantic. The efficient and rapid handling of vessels and their cargoes is a major factor in the choice of a bunkering port, and in the South Atlantic traffic Las Palmas at present leads Dakar in importance.

Shell has played a large part, with the local authorities, in the recent improvement of Dakar's harbour facilities. In order to provide a new oil storage area 10 acres of land have been reclaimed from the sea by Shell. Over 1,000,000 cubic feet of sand was taken from the harbour bed and used in the construction of breakwaters. On the reclaimed land four large tanks have been built by Shell, each able to hold 15,000 tons of diesel or fuel oils.

In addition, the Dakar Port Authorities have built a petroleum wharf costing £400,000. The total cost of these developments was about £950,000.

Lack of Progress in Assam

The search for more oil in the Nahorkatiya area of Upper Assam has received a setback in that the Assam Oil Company's ninth and tenth exploratory wells have been completed without striking oil.

Both wells were very deep and their failure is a serious and costly matter. Drilling operations are, however, continuing unabated at the Company's No. 11 and No. 12 wells, and a site has been chosen for a thirteenth well in the Nahorkatiya area.

Bitumen Tanker Launched

Esso's first vessel specifically designed for the carriage of bitumen was launched recently from the shipyard of Hall, Russell & Co Ltd at Aberdeen. The ship is the 2300-dwt *Esso Preston*, named at the launching ceremony by Mrs W. H. Critchlow, wife of the general sales manager of Esso Petroleum Co Ltd.

In a speech following the launching ceremony, Mr Critchlow said that the Company's bitumen business was expanding considerably and would expand even more if the recently-announced road programme was put into effect.

The dimensions of the *Esso Preston* are: length 297 ft,

breadth moulded 42 ft, depth moulded 20 ft 9 inches. Her service speed will be 10½ knots.

The vessel's cargo space consists of five centre compartments heated by 2-inch-diameter steam-heated coils, provided in the ratio of one square foot to every fourteen cubic feet of cargo. Discharge will be by two electrically-operated rotary displacement pumps with a capacity of 125 tons per hour for each pump.

Seismic Survey in Gambia

In Gambia recently the D'Arcy Exploration Company started a waterborne seismic survey to search for oil along 200 miles of the River Gambia. The survey is being carried out by Geomarine Service International from the vessel *Sonic*, which was engaged on similar work for B.P. in the Persian Gulf during 1955.

This preliminary survey is being made from the river as dense forest borders the River Gambia, but it will provide information on the rock structure beneath the land as well as beneath the river bed. Land surveys will probably be carried out later.

Two Major Refinery Projects in Venezuela

A twenty-inch diameter gas pipeline, 177 miles long and capable of carrying 106 million cubic feet of gas daily, is to be constructed between the La Paz oilfield and Cardon refinery by the Cia. Shell de Venezuela. The pipeline, which is expected to come into operation in 1957, will cost approximately £7½ million.

The construction of this pipeline will enable the natural gas produced with the crude oil to be used as the principal fuel in the refinery's furnaces, thus allowing more fuel oil, which might otherwise have to be used in the furnaces, to be exported.

A second project recently put in hand by the Cia. Shell de Venezuela is the construction of a fourth distillation unit at Cardon refinery, at a cost of £7¼ million. This unit will have a capacity of about 4 million tons a year and it will raise the yearly capacity of the refinery to 12¾ million tons.

Mobil Overseas Oil Company

A reorganization of the overseas operations of Socony Mobil Oil Company Inc. took effect on 1 January with the establishment of a wholly-owned affiliate, Mobil Overseas Oil Company, Inc.

The new company will integrate and be responsible for the activities of Socony Mobil and its affiliates in the Eastern Hemisphere and Latin America except for its interest in Standard-Vacuum, interests within Middle East concessionary areas, and producing operations within Venezuela, Colombia, and Peru.

The officers and directors of the Company have been drawn from senior members of the Socony Mobil Group.

Permanent P troleum Exhibition

A year or two ago the Institute invited subscriptions from the oil industry to provide a permanent petroleum exhibition within the chemical engineering gallery of the Science Museum in Kensington. Such an exhibition requires a great deal of thought and planning and for over a year an Institute of Petroleum Committee has been advising the Museum regarding the content of this exhibition.

In November 1955, however, the first case, depicting the winning of oil in a typical oilfield, was put on view to the public. It is the first of five or six cases which will show the whole process of oil production to the end of the refining stage.

"The Origin of Oil"—the first of the series of petroleum exhibits to be installed at the Science Museum

This first model is extremely well lighted; many of the cases will have push buttons to light up the operation of various processes.

In addition to the first case, a film projector has also been installed, a push button controlling the showing of a two-minute film outlining the molecular theory of cracking.

The Science Museum, with all its many working models, is a wonderful place for the science-minded youngster to explore and this new petroleum exhibition will undoubtedly prove a great attraction.

Oil Exploration in Red Sea

British Petroleum's prospecting subsidiary, The D'Arcy Exploration Company, is to search for oil in the area of the British group of Kamaran Islands and their territorial waters.

This group of islands lies off the coast of Yemen in the southern part of the Red Sea, and the islands are administered by the Government of Aden. Plans are already being drawn up for geological, gravity, and magnetic surveys of the land areas.

Oil Lecture at Science Congress

The 43rd session of the Indian Science Congress held at Agra in January included a popular lecture on the petroleum resources of India by P. Evans, geological adviser to the Burmah group of oil companies.

Mr Evans also addressed the Geology and Geography Section of the Congress on recent geological work in the Assam valley.

Russian Oilmen Visit Digboi

Recent visitors to Assam have included a party of Russians, three of them oil technicians, who spent five days at Digboi as guests of the Assam Oil Company.

The Soviet oilmen were specialists in petroleum geology, geophysics, and drilling, and an expert on higher education was also in the party.

During their stay the Russians visited the Digboi oilfield and refinery, toured the prospecting area of Upper Assam, visited seismic survey operations in the Hugrijan area, and

made a geological expedition to Nomdang. A visit was also made to the geological, paleontological, petrological, and chemical offices and laboratories of the Assam Oil Company.

CONFERENCE ON PLANT AND PROCESS DYNAMIC CHARACTERISTICS

A conference on the dynamic characteristics of plant and processes is to be held by the Society of Instrument Technology Ltd at the Engineering Laboratory, Cambridge, from 4 to 6 April this year.

Among the papers of particular interest to members of the petroleum industry will be: "The Distillation-Column Reboiler" by R. L. Day, "An Investigation of the Transient Response of a Distillation Column" by Dr W. D. Armstrong and W. L. Wilkinson, "Response of Concentrations in a Distillation Column to Disturbances in the Feed Composition" by Dr H. Voetter, and "An Analogue Simulator Applied to the Study of an Operating Process Control Loop" by N. Ream, R. H. Tizard, and D. S. Towend.

Further information about the conference can be obtained from S.I.T. 1956 Conference Secretary, Engineering Laboratory, Trumpington Street, Cambridge.

DIESEL OIL DUTY

A suggestion that duty on diesel oil should be reduced by sixpence per gallon was countered by a plea from Mr R. Bell that the present tax should be doubled in a recent interchange of views at Question Time in the House.

Mr Ernest Davies first broached the subject by asking the Chancellor of the Exchequer for an estimate of the total loss of revenue which would result from the reduction of duty on diesel oil by sixpence per gallon and by the total exemption of diesel-engined goods vehicles and passenger service vehicles from such duty.

In reply, Mr H. Brooke said that the immediate loss in revenue would be £10 million a year as a result of a reduction of sixpence per gallon in duty. The loss resulting from the exemption from this duty of oil for diesel-engined goods vehicles and passenger service vehicles would be about £20 million and £30 million a year respectively. Any such tax changes would, of course, encourage users to switch from petrol to diesel oil vehicles, so that the loss of revenue would increase progressively.

★ ★ ★

Forthcoming Meetings

THE INSTITUTE

(*At* 26 *Portland Place, London, W.*1, 5.30 *p.m.—tea* 5 *p.m.*)

A Legal Department in an Oil Company. F. U. J. O'Brien, LL.B. **8 February**

Considerations Affecting the Choice of Refinery Utility Installations. J. A. Shaw, B.A., A.M.I.Mech.E., A.F.Inst.Pet. **14 March**

IP FAWLEY BRANCH

(*At Esso* (*Fawley*) *Recreation Club, Holbury*, 7.30 *p.m.*)

Exploring in North Greenland. Colin Bull, Ph.D., B.Sc. **17 February**

World Energy, Supply, and Demand. M. E. Hubbard, B.A., M.I.Mech.E. **16 March**

IP LONDON BRANCH

(*At* 26 *Portland Place, London, W.*1, 6 *p.m.—tea* 5.30 *p.m.*)

Petroleum Refining in the United Kingdom. W. Kohring. **29 February**

Presidential Address. **20 March**

IP NORTHERN BRANCH

(*At Engineer's Club, Albert Square, Manchester* 2, 6.30 *p.m.*)

Annual General Meeting. Speaker—Group Captain Bader, D.S.O., D.F.C. **21 February**

Shock Absorbers. J. W. Kinchin. **20 March**

IP SCOTTISH BRANCH

The Design and Manufacture of Welded Pressure Vessels. T. B. Webb. (At Inst. of E. Engineers & Shipbuilders, 39 Elmbank Crescent, Glasgow, 7.45 p.m.) **14 February**

Corrosion Control by Water Treatment. Dr R. S. Thornhill (Afternoon). **Water Treatment for Recirculating Cooling Systems.** C. W. Drake (Afternoon). **Boiler Water Conditions at Ultra High Pressures.** Dr C. D. Weir (Evening). (Afternoon session at Leapark Hotel, Grangemouth; evening session at G.P.R. Hall, Grangemouth). **2 March**

IP SOUTH-EASTERN BRANCH

(*At King's Head Hotel, Rochester*, 7.45 *p.m.*)

Atomic Power. I. Wells, B.Sc., M.I.Chem.E. **7 February**

The Production of Town Gas by the Catalytic Gasification of Petroleum Oils. J. B. McKean, B.Sc., M.Inst.Gas E., A.R.I.C., A.M.I.Chem.E.

Film—*Get Off the Hose.* **6 March**

IP SOUTH WALES BRANCH

(*At Training Centre, National Oil Refineries, Llandarcy*, 5.30 *p.m.*)

The Development of High Performance Lubricating Oils. J. G. Withers, B.Sc., M.I.Mech.E. **1 March**

IP STANLOW BRANCH

(*At Grosvenor Hotel, Chester*, 7.30 *p.m.*)

Combustion of Liquid Fuels. G. J. Gollin, M.A., M.Inst.F., M.I.Mech.E. (Joint meeting with Institute of Fuel) **15 February**

Fuels and Lubricants for Jet Engines. K. C. Hunt, A.C.G.I., F.Inst.Pet., A.M.I.Mech.E., A.F.R.Ae.S. (Joint meeting with Royal Aeronautical Society). **21 March**

ECONOMICS AND OPERATIONS GROUP

(*At* 26 *Portland Place, London, W.*1, 5.30 *p.m.—tea* 5 *p.m.*)

Retaining Refinery Production in Balance for the U.K. Market. B. F. Newton. **6 March**

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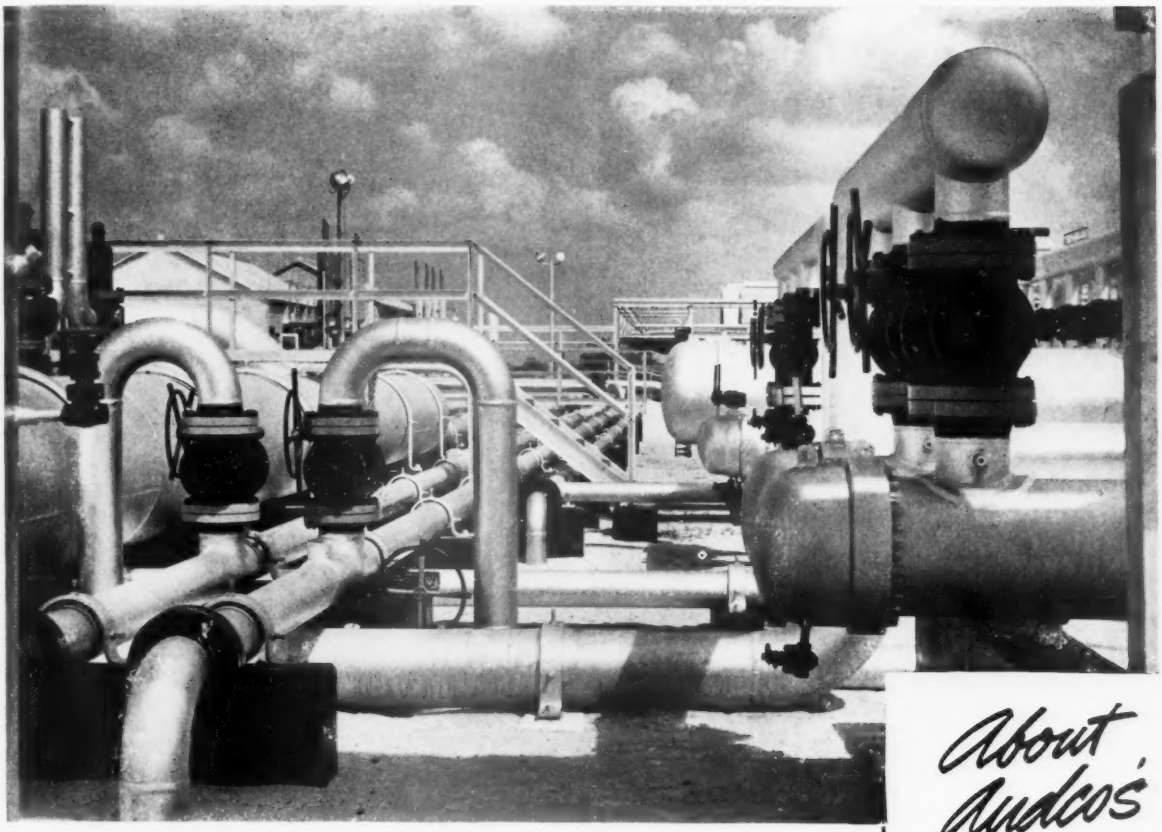

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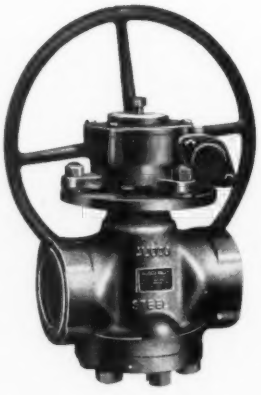

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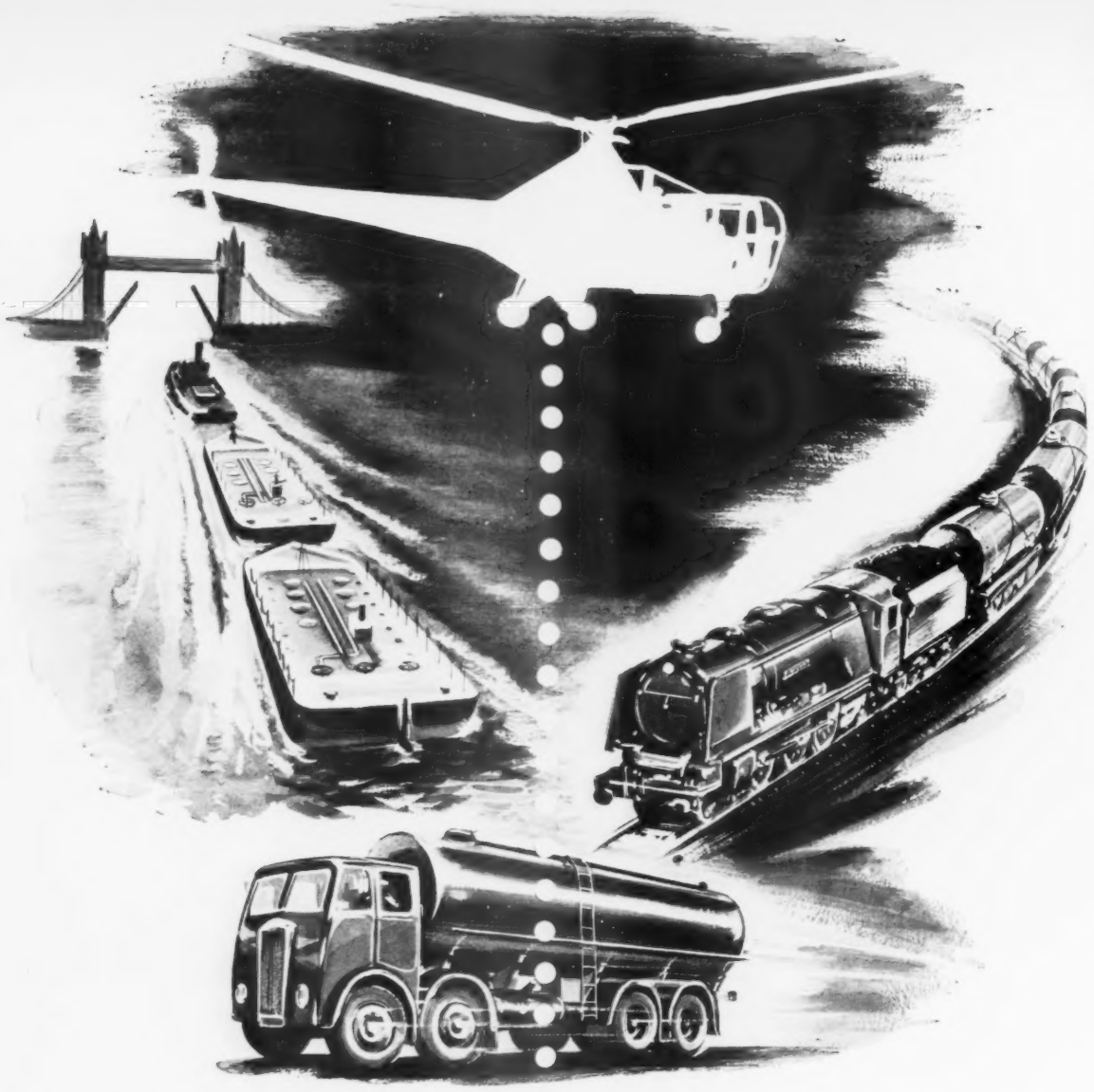

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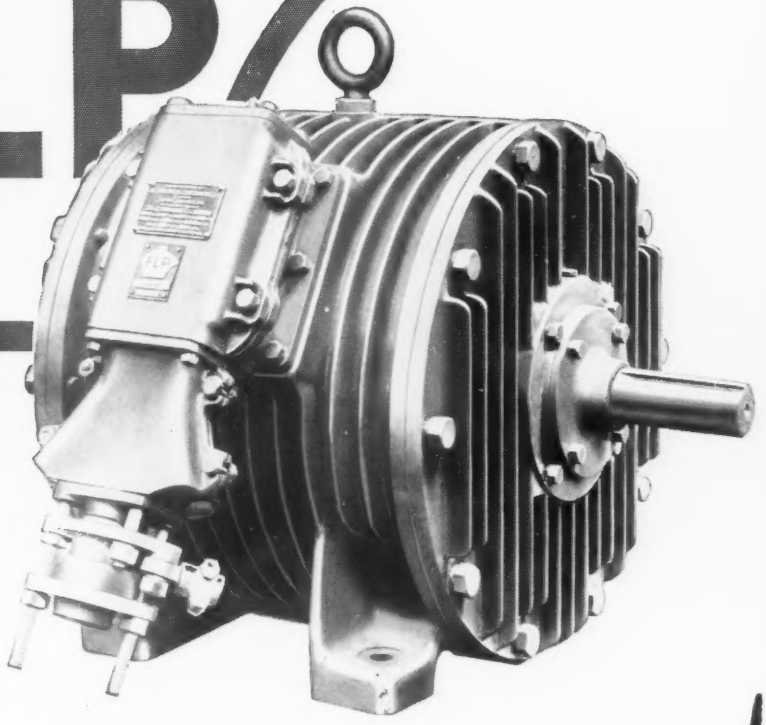

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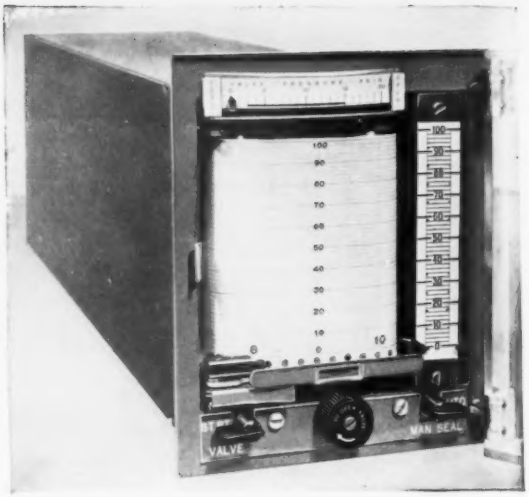

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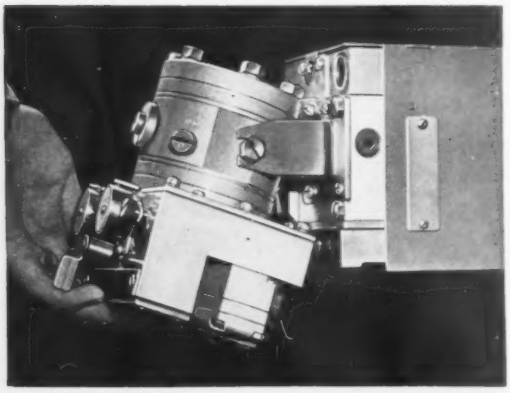

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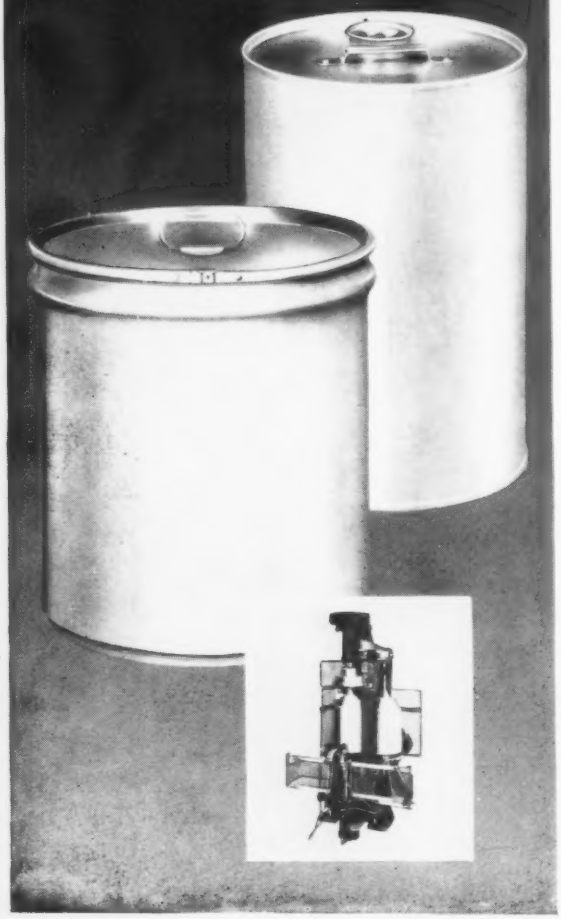

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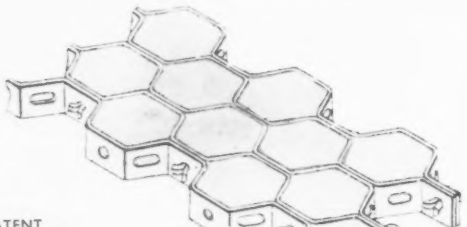

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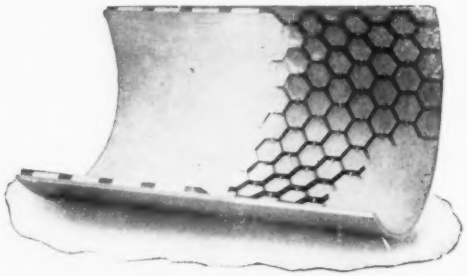

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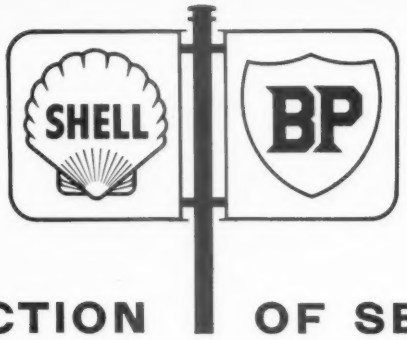

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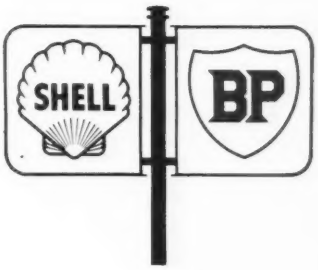

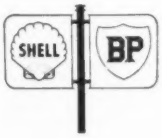

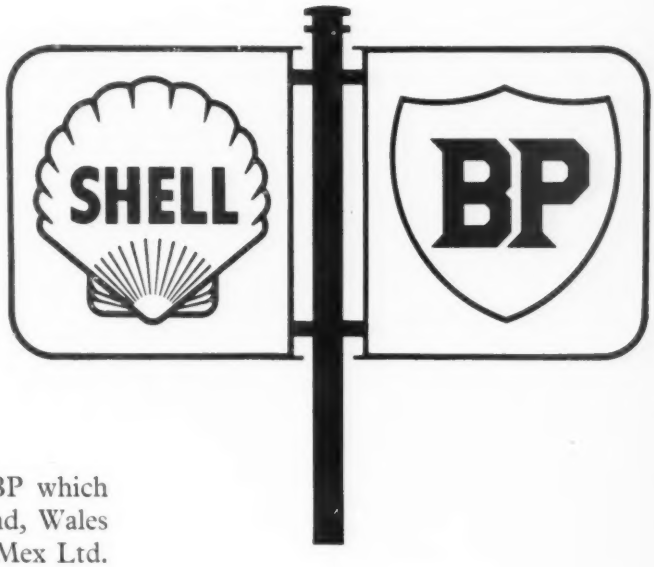

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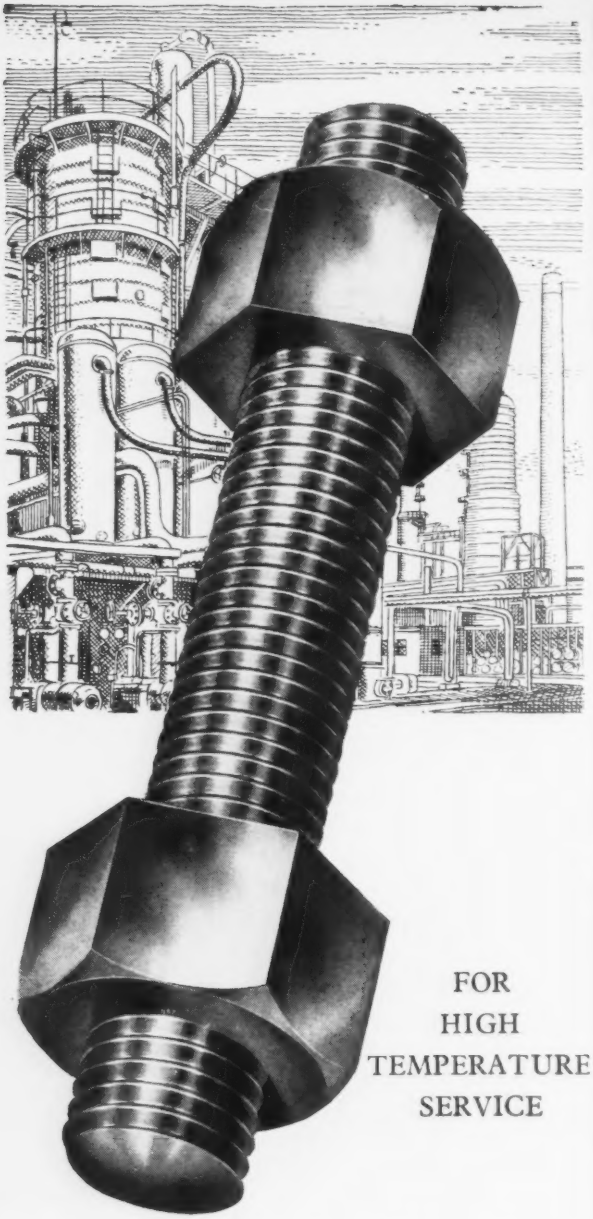

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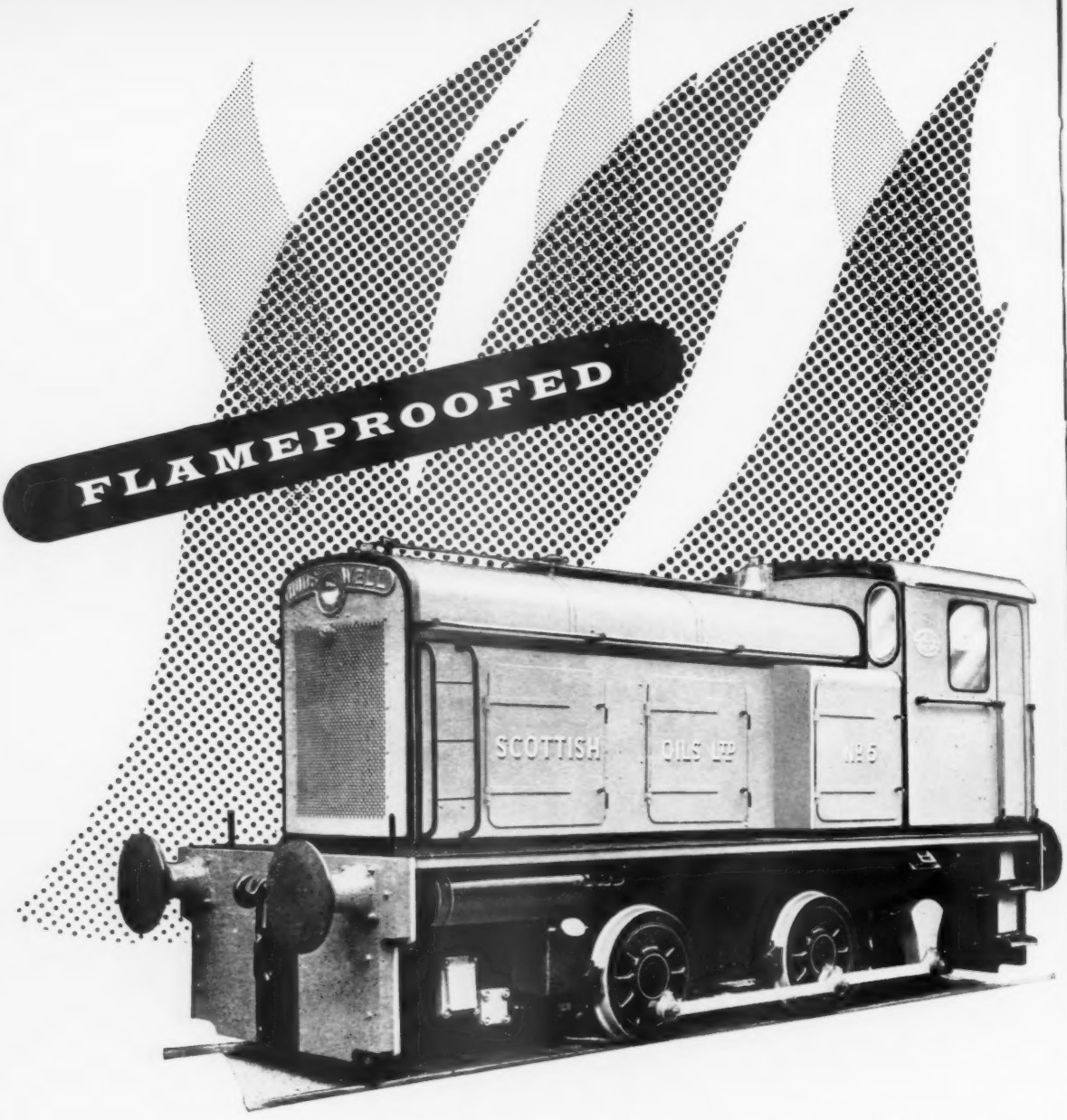

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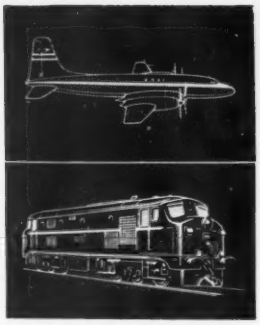

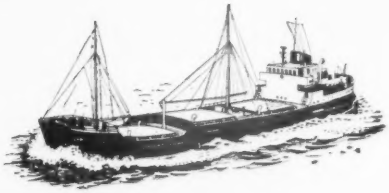

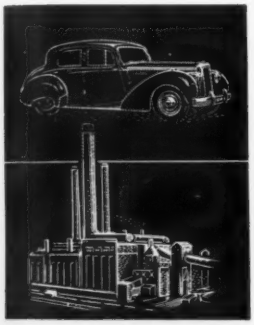

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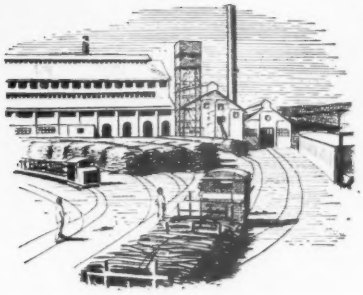

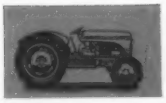

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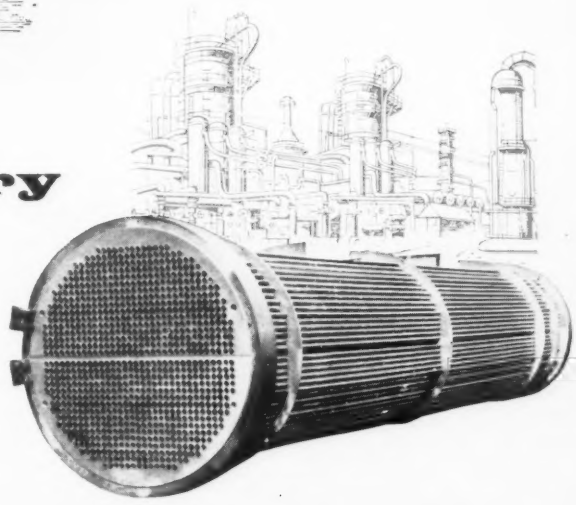

SERCK heat exchangers owe their reliability in no small measure to the Serck non-ferrous tubes used in their construction. Tubes of the same high standard also find application in sugar-making machinery, condensers for steam turbines and in the Petroleum Industry.

The range of Serck petrol tubes includes cupro-nickel, 70/30, Admiralty brass, aluminium brass and aluminium bronze. To withstand the adverse conditions encountered in petroleum refining, Serck tubes are manufactured to all accepted international specifications and to a controlled analysis.

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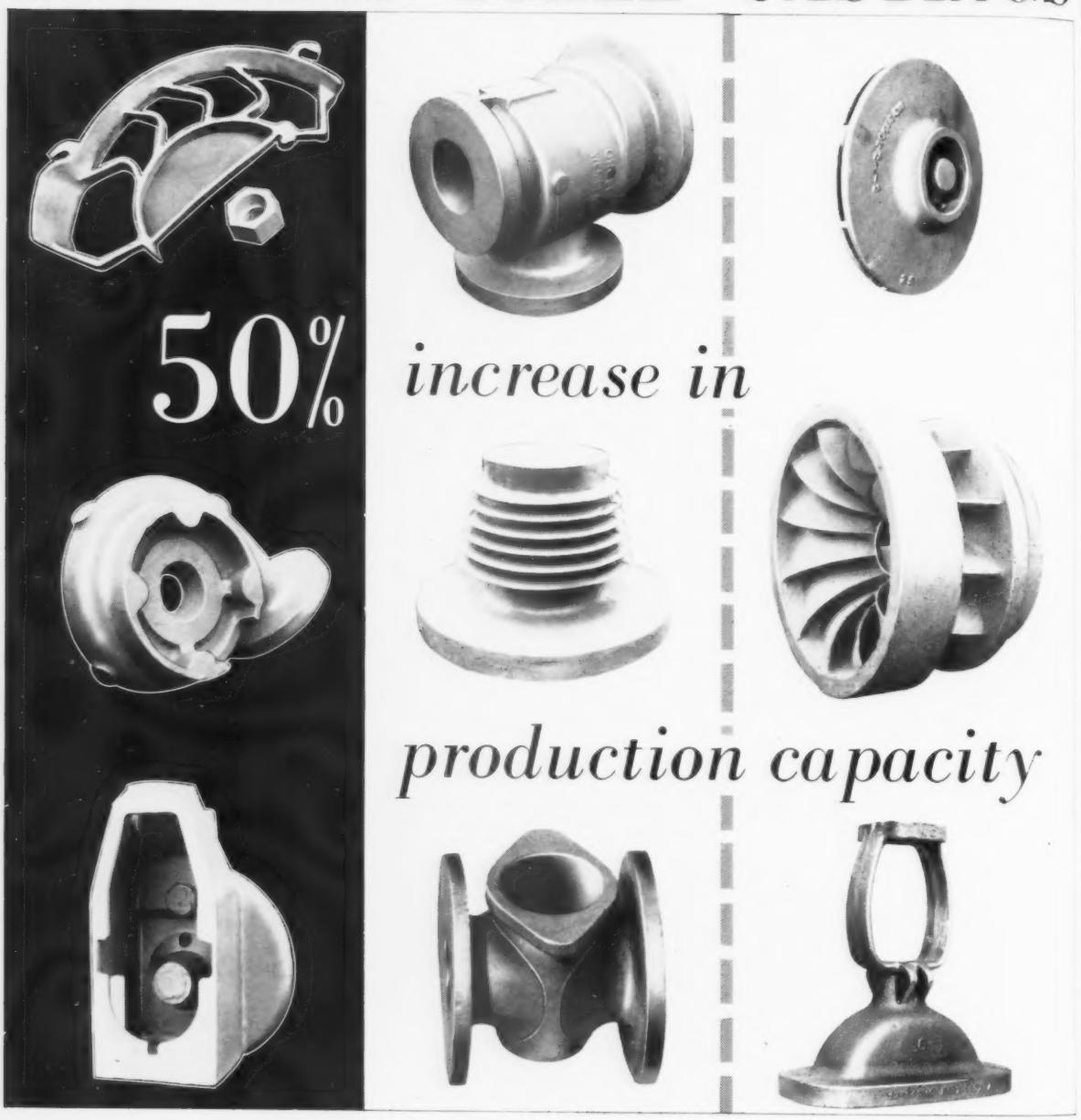
STAINLESS STEEL CASTINGS



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MOLS PER 100 MOLS OF HYDROCARBON CHARGED

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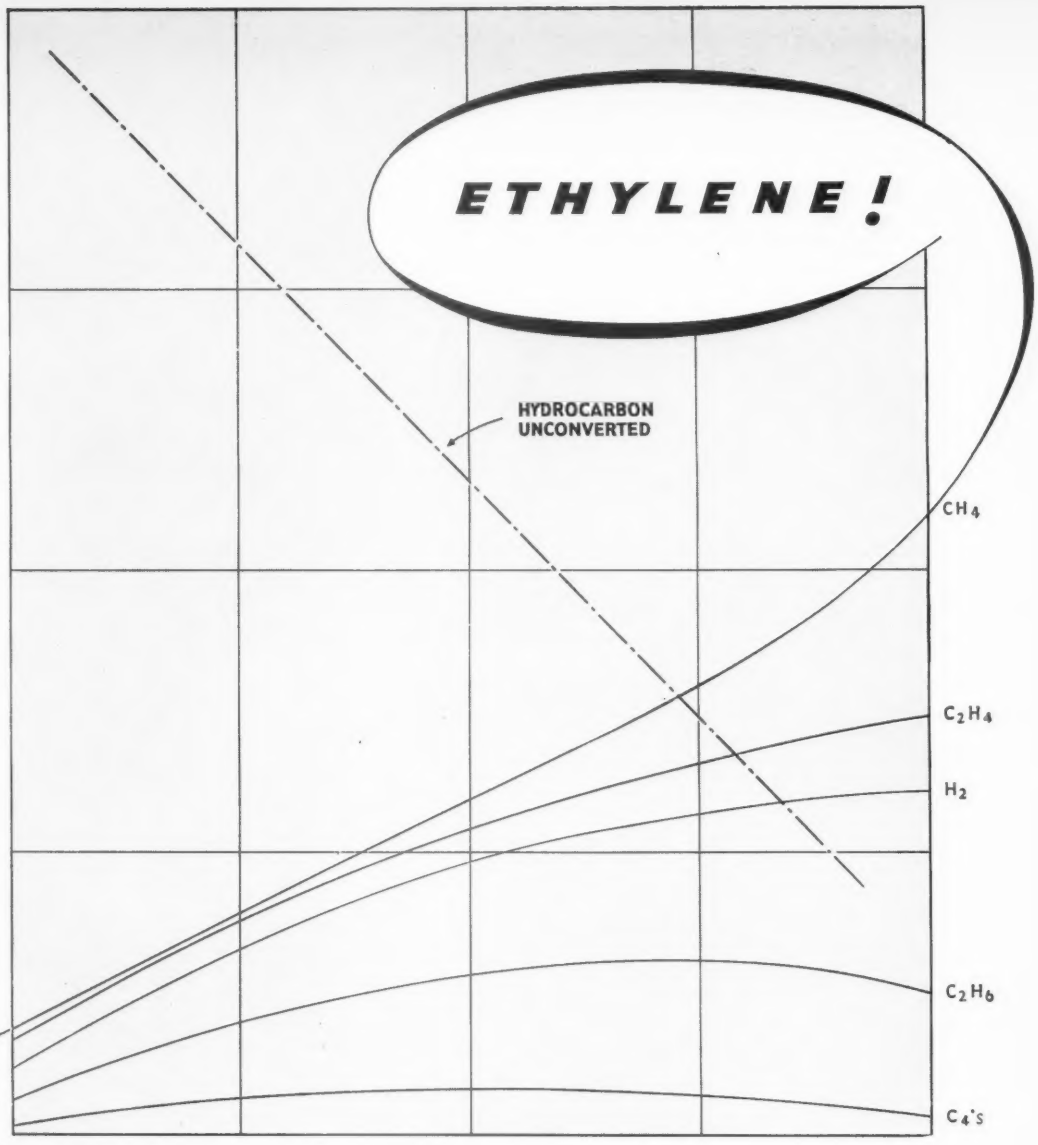

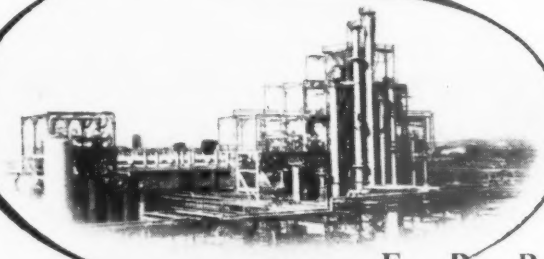

Our American affiliate, the Stone & Webster Engineering Corporation, has projects for ethylene production on the drawing boards which, together with plants built in the past, represent an output of this valuable chemical of over 3,000,000 pounds per day. The reservoir of experience of the Stone & Webster engineers in this field is available to our clients and is being drawn upon for ethylene plants and associated process units we are presently building in Scotland and France.

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